Report of the Lake Erie Yellow Perch Task Group

March 2002

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Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

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Note: The data and management summaries contained in this report are provisional. Every effort has been made to insure their correctness. Contact individual agencies for complete state and provincial data. Data reported in pounds for years prior to 1996 have been converted from metric tonnes. Please contact the Yellow Perch Task Group or individual agencies before using or citing data published herein.

Introduction

From April 2001 through March 2002, the Yellow Perch Task Group (YPTG) addressed the following charges:

- complete an independent review of yellow perch population models and methods used to recommend harvest strategies
- maintain and update the centralized time-series data set of harvest, effort, growth, abundance, recruitment, biomass and maturity
- produce a lake-wide Recommended Allowable Harvest (RAH) partitioned by Lake Erie management unit
- investigate further yellow perch stock discrimination through genetic research
- continue examining factors that assist bioenergetic modeling.

This year, the task group's assessment process evolved further by updating our more flexible programming and modelling tool for catch-age analysis. We completed an independent review of catch-age and yield per recruit methods employed in deriving RAH. Using these new methodologies, the status of Lake Erie yellow perch stocks is described herein.

2001 Fisheries Review

The reported harvest of yellow perch from Lake Erie in 2001 totaled 6.956 million pounds, which was a 15% increase over the 2001 harvest (Table 1). Yellow perch harvest (pounds) in 2001 increased from the previous year for all jurisdictions: Ohio (18%), Michigan (6%) and Ontario (11%), and considerably for Pennsylvania (129%) and New York (523%).

For yellow perch assessment and allocation, Lake Erie is partitioned into four Management Units (Units, or MUs; Figure 1). The distribution of harvest among jurisdictions in 2001 remained similar to 2000 (Table 1, Figure 2). Harvest, fishing effort, and catch rates are summarized for the time period 1988-2001 by management unit, year, agency, and gear type in Table 2, parts a through d. Trends over a longer time series (1975-2001) are depicted graphically for harvest (Figure 3), fishing effort (Figure 4), and catch rate (Figure 5) by management unit and gear type. Harvest summed by management unit showed a decrease in Unit 1 (14%), but increased in Unit 2 (33%), Unit 3 (25%) and Unit 4 (21%). In 2001, Ontario's harvest declined in Unit 1 (17%), but increased in Unit 2 (21%), Unit 3 (30%) and marginally in Unit 4 (1%). Michigan's harvest (Unit 1) increased by 6% from 2000.

Ohio's yellow perch harvest decreased in Unit 1 by 12%, but increased in Units 2 and 3 by 49% and 5%, respectively. Pennsylvania's fisheries, albeit small, increased dramatically in Unit 3 (180%) but declined in Unit 4 (24%). New York's sport harvest in 2001 (15,292 lbs) was more than eight times the magnitude observed in 2000, and was comparable to 1990 harvest levels (Table 2d).

Ontario's reported yellow perch harvest is represented exclusively by the commercial gill net fishery. Relative changes in harvest were discussed in the previous paragraph. The sport harvest of yellow perch in Ontario offshore waters is not routinely assessed. Harvest from commercial trap nets decreased in Unit 1 (25%) and Unit 3 (96%), but increased in Unit 2 (60%), while trap net harvest in MU 4 was negligible (Tables 2a - 2d). In 2001, sport harvest decreased in Unit 1 (7%), but increased in Unit 2 (39%), Unit 3 (78%) and Unit 4 (85%).

In 2001, 10% of the lake wide gill net harvest was from mesh sizes 3 inches (76 mm) and greater. This component of the harvest included both targeted and incidental catch. Harvest, effort and catch per unit effort from *a*) standard yellow perch effort (<3 inches) and *b*) larger mesh sizes, are distinguished in Tables 2a to 2d. The harvest in larger mesh sizes reflects the composition of larger, older yellow perch among management units not evident since the early 1990's. In Unit 1, commercial gill net effort was the lowest recorded over the time series (Table 2a). Standard yellow perch effort declined significantly in 2001 by 68%, 45%, and 59% in management units 1, 2 and 4 respectively, but increased marginally from 2000 (5%) in MU 3 (Tables 2a to d).

Trap net effort for 2001 experienced a significant lakewide decline: Unit 1, down 62%; Unit 2, down 10%; Unit 3, down 89%; and Unit 4, down 11%. Compared to 2000, sport fishing effort for 2001 decreased by 28% in Unit 1 and 3% in Unit 2, but increased 32% in Unit 3, and 49% in Unit 4.

Catch rates (catch per unit of effort, or CPE) for the 2001 commercial small-mesh gill net fishery increased dramatically in all Management Units: up 126% in Unit 1, 95% in Unit 2, 17% in Unit 3 and 290% in Unit 4. Trap net catch rates for 2001 also increased in Units 1 and 2, but declined in Units 3 and 4, partially based on low effort expended: Unit 1, up 98%, Unit 2, up 78%, Unit 3, down 61%, and Unit 4, down 88%. Catch rates for anglers targeting yellow perch (in fish per hour) increased in Unit 1 for Ohio (13%) and for Michigan (32%). In the central basin (MU 2 & 3), catch rates increased 10% for Ohio in MU 2, but decreased by 3% in MU 3. Pennsylvania angler catch rates increased by 37% in MU 3. In the east basin (MU 4), catch rates increased greatly (750%) in New York, but decreased (12%) in Pennsylvania waters.

The lakewide RAH range recommended by the YPTG for 2001 was 5.2 to 6.8 million pounds lakewide. The Lake Erie Committee supported a total allowable catch (TAC) lakewide allocation of 7.1 million pounds. Partitioned by YPTG Management Unit, TAC values for 2001 were: Unit 1, 1.8 million pounds; Unit 2, 3.5 million pounds; Unit 3, 1.73 million pounds; Unit 4, 0.07 million pounds. The 2001 lakewide harvest of Lake Erie yellow perch at 6.956 million pounds did not exceed total allowable catch set by the Lake Erie Committee. Harvest in each management unit remained under the TAC in each management unit with a small exception in MU 2 (41 thousand pounds). The 2001 harvest in millions of pounds by Management Unit were: Unit 1, 1.800 million pounds; Unit 2, 3.541 million pounds; Unit 3, 1.555 million pounds; Unit 4, 0.060 million pounds. The 2001 Lake Erie yellow perch fisheries attained (calculated from harvest values in Table 1) 100% of TAC in Unit 1, 101% of TAC in Unit 2, 90% of TAC in Unit 3 and 85% of TAC in Unit 4.

Independent Yellow Perch Model Review

In 2001, the Lake Erie Committee of the Great Lakes Fishery Commission initiated an independent review of methods used to assess yellow perch stocks in Lake Erie. The review addressed population modeling, harvest strategies, and considerations for decision making and risk assessment. Drs. Ransom Myers and Jim Bence conducted the review with materials provided by the Yellow Perch Task Group (YPTG). They performed alternative analyses, provided constructive criticism and offered suggestions concerning existing and potential approaches.

The review indicated general agreement between YPTG and alternative analyses for the western and central basins. The reviewers stated that YPTG assessment and management procedures led to reasonable exploitation rates. The reviewers made numerous suggestions for improving the population modeling and harvest strategies for the western and central basins. An external review of Management Unit 4 was not possible due to unresolved stock definitions. A brief discussion of the major areas identified by the reviewers for improvement or investigation is provided below.

The reviewers identified some inconsistency between the YPTG population modeling approach and parameterization of the Beverton-Holt Yield per Recruit (Y/R) method for calculating $F_{0.1.}$ Examination of an alternative exploitation strategy applying the method of Thompson and Bell (1934) was less conservative than the Beverton-Holt Y/R and may lead to greater risk. The reviewers identified the need to incorporate the spawner – recruitment relationship into assessment / harvest strategies with suggested approaches. The YPTG has made considerable progress in evaluating the use of spawning stock biomass and other biological reference points in the harvest strategy. From independent analysis, the reviewers noted that survey residuals used in model fitting suggested aging error. YPTG members have been evaluating the accuracy of age estimation by their respective agencies.

The reviewers recommended exploring modifications to the existing AD Model Builder Catch-at-Age Analysis (ADMB) code or using a Virtual Population Analysis (VPA) approach (assumed catch without error). The rationale of the former suggestion was to reduce the influence of fishery effort and rely more on survey data for abundance estimates. This concern has been partially addressed in the YPTG's preparation for the 2002 assessment through ongoing modifications to the reviewed model. Reviewers also identified changing selectivity related to growth as a source of uncertainty in the assessment process. They suggested alternative length-based methods for estimating selectivity. This approach has been incorporated by the YPTG in the latest ADMB (CSI) model. Use of the geometric mean and related transformations on Lake Erie survey data in ADMB was also discussed. Reviewers advised using the arithmetic mean until the matter is investigated further. The YPTG has implemented this change for the gillnet fishery and survey gear. The reviewers had some questions about the function of parts of the ADMB code that were not described very well in the documentation they received. These concerns have been addressed to their satisfaction.

The Yellow Perch Task Group believes that the results of the independent review confirm that the 2001 Lake Erie yellow perch assessment was sound. The YPTG further expects that changes to the population model, as a result of the external review, have refined the model and will produce better estimates of age specific abundance. The YPTG also recognizes that projection of the abundance of age 2 fish, those just entering the fishery, will continue to be a major challenge.

The YPTG wishes to express our thanks to Drs. Myers and Bence for their critical review and comments on the Lake Erie yellow perch modeling and exploitation strategies. The YPTG has made a significant effort in this last year to incorporate recent modeling strategies and knowledge gained from technical workshops and the external review. The task group also wishes to thank Dr. Pat Sullivan (Cornell University) for his introduction to and continued guidance using AD Model Builder for yellow perch stock assessment.

Stock Assessment

Age and Growth

Age distributions in the fisheries' harvest (Table 3) showed some similarities within management units and within gear types, but there were some key differences. There was strong representation from the 1998 (age 3) and 1996 (age 5) year classes in all MUs and gears. There was poor representation of the 1999 year class (age 2) in commercial gear due to gear selectivity and relative weakness compared to the 1996 and 1998 cohorts. The 1997 year class (age 4) representation was most variable; it was moderately strong in gill nets across all Units, but relatively weak in trap nets and angler catches in all MU's, particularly in the eastern half of the lake.

While yellow perch populations recover from the low levels of the early nineties, trends in growth at various life stages appear to differ by basin. Western and eastern basin growth trends appear to lag behind the central basin. Young-of-the-year (YOY) growth had shown a general declining trend during the nineties, but this trend appears to be reversed since 1998 (Figure 6). Age 2 yellow perch experienced declining growth in MU 1 since 1993 and this trend was carried forward in subsequent years by age 3 and 4 yellow perch (Figure 6), but that trend is being reversed by recent cohorts. In the remaining areas of the lake, YOY growth has fluctuated considerably, appears to be improving in recent years, but may be related to density dependence. The size of yearling and older yellow perch also fluctuated greatly during the nineties in the other management units, though growth in recent years seems better than average.

Growth differs between areas in Lake Erie due to unique thermal environments, thermal history, changes in yellow perch forage composition and, if food resources are limited, abundance of yellow perch and species with diets that overlap at various life stages. In the latter case population dynamics, community composition, and the spatial distribution of predators could play a role in the differential growth of yellow perch.

The task group continues to update yellow perch growth in: (1) weight-at-age values recorded annually in the harvest and (2) length and weight-at-age values taken from interagency trawl and gill net surveys. In general we have seen increasing weight–at-age values for these parameters in each management unit. These values are important in our calculation of available biomass and for calculating harvest in the next year.

Catch-Age Analysis and Population Estimates

ADMB Catch-Age Analysis 2001/2002

At Higgins Lake, we finished up the independent review meeting with a model that was well advanced from earlier versions but far from perfected. That model had catchability blocks, selectivity that varied with age (but not with size-at-age), an older version of the Partnership data set, and some inconsistency among management units with respect to how λ s (weighting factors) were estimated.

As in the past, three-fishery gears (gill net, trap net and sport) were incorporated into this year's ADMB catch-age analysis models using harvest-by-age, effort, and weight-at-age data. Survey gear (Partnership index gillnet and trawl) CPUE at age data were also incorporated in ADMB catch-age analysis models to estimate population size (1975-2001) in numerical abundance and biomass for each management unit. Natural mortality (M) remained fixed at 0.4, as determined by a previous YPTG review (YPTG 1997). This parameter exerts a small influence on population scaling, but was assumed constant among years and management units.

This year we made some global changes to our ADMB models that incorporated independent reviewer suggestions. The end result of completing these changes has been improving model runs and fit. First, we have incorporated a vector of coefficients to adjust annual commercial catchability coefficients to reflect seasonal differences. These vary from year to year and are different between MUs. Second, all ADMB models use the variance-ratio technique to estimate λs as presented in Quinn and Deriso (1999). This allows all λs to be calculated in the ADMB program rather than being calculated by the YPTG independently outside of the program. Third, all ADMB models use Partnership data sets that have been corrected for observed changes in selectivity. Fourth, all models have expanded bounds on parameters as the independent reviewers requested.

The reviewers at Higgins Lake strongly emphasized adapting an ADMB model that incorporated size-based selectivities. We estimated size-based selectivities for commercial gillnets only, and then used the resulting matrix of selectivities at age and year in the catch equation for the gillnet fishery (the Commercial Selectivity Index or CSI Model). All other components of the CSI model are similar to the updated Higgins Lake model. The CSI model produces what the YPTG feels are more accurate estimates (although somewhat less precise). We believe that the loss of precision may be result of biased catch records. We are also looking into this, but the intensity of fishing in grids split by or bordering MU boundaries could be an important factor.

Nevertheless, the one main difference in the interpretation of the results is each model version produces quite different abundance estimates of 2-year-old fish (the 1999 year class). It was apparent to the YPTG that the CSI model produced results that were closer to those predicted by previous regression estimates and represented a more conservative approach to population estimation in light of the aforementioned uncertainties. Therefore, we are presenting only the results of the CSI model.

Estimates of population size and parameters such as survival and exploitation rates are presented for 1988-2001 in Tables 4 and 5 and for 1975-2001 in Figures 7-10. Estimates of age 2 recruitment in 2001 were derived using linear regression of previous years' age 2 population estimates and juvenile indices (Appendix). Population estimates for 2002 incorporate these recruitment estimates of age 2 yellow perch (Table 5 and Figure 7). Mean weight-at-age from biological surveys was applied to abundance estimates to generate biomass estimates (Table 5 and Figure 8).

Catch-age analysis suggests that former standing biomass levels of the seventies and eighties have been achieved in the central basin (Figure 8). Recent studies indicate that Lake Erie is considered less productive following reduced phosphorus loading and Dreissenid mussel colonization. While signs of recovery are evident, the task group maintains that current sustainable production is below historical levels. Exploratory long-term ADMB model runs (1960-2001) show that historic abundance and biomass levels have not been achieved by recent population rebounds.

There are also a number of considerations that limit our confidence in the estimates over the entire time series presented in Figures 7 and 8. Recent modeling (ADMB) incorporated survey gear to provide less biased estimates of population size. Survey data were limited to the nineties and in some cases the eighties, though survey methodology differed between decades. This lack of survey continuity over the time series for which we've estimated population size, contributes to uncertainty when comparing recent levels to historical levels of abundance. Other assumptions including a constant natural mortality rate from 1975 to 2000, and compatibility of old versus new harvest data, lessen our ability to directly compare abundance levels over three decades. The YPTG also recognizes that the most recent years' data estimates inherently have the widest error bounds associated with them.

Recruitment Estimator for Incoming Age 2 Yellow Perch

The Yellow Perch Task Group continues to use interagency trawl data series for predicting age 2 recruitment from linear regression against catch-age analysis estimates of two-year-old abundance. Age 2 recruitment in 2002 was calculated using the mean of values predicted from the indices listed in the Appendix Table A-1. Data from trawl index series for the time period examined are presented in Appendix Table A-2 (geometric means) and A-3 (arithmetic means), while a key summarizing abbreviations used for the trawl series is presented as a Legend in the Appendix.

We have improved our regression methods based on the independent reviewers' comments. The YPTG is examining density-dependent factors that influence recruitment of juvenile yellow perch to older ages. These factors could result in overestimation of age 2 recruits at moderate to high levels of recruitment by linear regression methods. Conversely, improved survival at extremely low cohort abundance levels may result in slightly better than predicted recruitment. The task group will continue to investigate these improvements to our models and predictions for age 2 recruits as they enter the fisheries and our future modeling efforts.

Estimated age 2 recruitment for 2002, from the 2000 year class, appears to be one of the smallest in recent time series in all management units (Table 4 and Appendix). Both original regression and density-dependent regression methods used for estimating age 2 show that the 2000 year class is very weak in each MU and will not contribute much to the fisheries in 2002 and beyond. Based on YOY indices in all management units, however, expectations for the 2001 year class are promising.

2002 Population Size Projection

Stock size estimates for 2002 (ages 3 and older) were projected from the ADMB 2001 population size estimates and age-specific survival rates in 2001 (Tables 5 and 6). Age 2 recruitment values for the 2000 year class in 2002 (methods described above) were then added into the age 3 and older population size estimates in each unit to give a 2002 population of yellow perch ages 2 and older (Table 6). Standard errors and ranges about our mean estimates are provided for each age in 2001, and following estimated survival (from ADMB), for 2002. Population changes are influenced by the moderate recruitment of the 1999 year class, the weak 2000 year class, and coupled with the strong 1998 year class (which has already received moderate exploitation). The 1996 year class is not expected to contribute significantly to the fisheries in 2002 and beyond as it has been subjected to natural mortality for 5 years and heavily exploited by the fisheries for 3 years.

Stock size estimates (ages 2 and older) for 2002, compared to 2001, show moderate declines due to the weak incoming 2000 year class at age 2. Abundance of age 2 and older yellow perch are 35% lower in MU 1, 39% lower in MU 2, 37% lower in MU 3, and 17% lower in MU 4. Abundance of age 3 and older yellow perch in 2002 are estimated to be higher than in 2001 in MU 2 by 2%, but lower than 2001 in MU 1 (-1%), MU 3 (-24%) and MU4 (-32%).

Biomass estimates show similar trends to abundance but their declines have been mitigated by increased growth rates and larger weight at a given age. A weak 2000 year class entering at age 2 with some stronger, older year classes (1996, 1998) will also have the effect of lessening the biomass decline of older fish. Biomass of age 2 and older yellow perch in 2002 declined compared to 2001 levels by 26% in MU1, 32% in MU2, 24% in MU3, and 4% in MU4. Biomass of age 3 and older yellow perch saw declines of 4% in MU1, 2% in MU2, 14% in MU3, and 12% in MU4.

Survival of yellow perch ages 2 and older in 2001 was estimated (in ADMB) to be 61%, 56%, 58% and 66% in MU 1, 2, 3 and 4, respectively. Survival rates for ages 2 and older yellow perch increased slightly in MU1 and remained constant or declined slightly in the remaining units. Survival of age 3 and older yellow perch increased from 2000 in each unit (Figure 9). Survival of yellow perch ages 3 and older in 2001 was estimated to be 59%, 53%, 57% and 66% in MU's 1 to 4, respectively. Generally, survival rates have shown a gradual increase across all management units since the early to mid 1990s (Figure 9).

Exploitation rates decreased slightly or remained the same as 2000 levels, with the exception of small increases in exploitation for ages 2+ for the central basin, Units 2 and 3 (Figure 10). The YPTG has noted that observed fishing mortality of yellow perch ages 3 and older has been less than or equal to F_{opt} in recent years.

Harvest Methodology

The yield per recruit model used to calculate a recommended harvest in 2002 was similar to that used in 2001, though von Bertalanffy growth parameters have been recalculated to reflect current trends in growth, so F_{opt} is higher in each MU than in 2001. The optimum harvest rate, F_{opt}, is determined by balancing growth rate with natural mortality rate. For temperate waters, F_{opt} is modified to $F_{0.1}$, which corresponds to 10% of the initial rate of increase in yield per recruit relative to increasing F (fishing mortality) at low levels of fishing. F_{opt} values are presented in Table 6 for projecting 2002 harvest. F_{opt} values are scaled by selectivity values generated by ADMB so that targeted fishing mortality may differ between partially and fully vulnerable age groups. A full description of the model inputs, as well as the steps required to determine a scaled $F_{0.1}$, is given in previous reports (YPTG 1991, 1995).

Other factors updated for yield derivation include calculating mean weight-at-age in the population (Table 5) and mean weight-at-age in harvest (Table 6). In both cases, as in prior YPTG methods and reports, the recent two-year average was used in each management unit. These values are based on intensive sampling from interagency surveys, creel surveys and commercial fishery sampling.

This past year, the YPTG examined other methods of producing yield estimates and Recommended Allowable Harvest. These methods included analysis of Spawning Stock Biomass Fx% (Clark 1991) and Thompson-Bell yield per recruit (Thompson and Bell 1934, Ricker 1975) harvest scenarios. Full analysis of both methods are incomplete at this time; however, the YPTG will continue to examine these yield methods as we begin to incorporate Biological Reference Points, Decision Analysis and Risk Analysis methodologies in our future yield calculations and harvest recommendations.

Recommended Allowable Harvest

For 2002, there were a number of considerations for recommending allowable harvest. In accordance with the Lake Erie Percid Management Strategy, continued conservative exploitation contributes to the goal of stock sustainability. New methodology was adopted this year in two forms. Catch-age analysis using ADMB with auxiliary survey data and commercial selectivity definitions was used to estimate population size in each management unit. This represents an improvement recommended by the independent reviewers. Additionally, the targeted fishing mortality rate, F_{opt}, was increased in each management unit in response to recent changes in growth reflected by von Bertalanffy parameters, which are variables in the yield per recruit model. Growth of yellow perch has begun to rebound in recent years in all MU's. The mechanism of this change will continue to be investigated over the next few years.

Projected recommended allowable harvests for age 2 and older fish in 2002 are calculated in Table 6 and summarized by management unit in Table 7. The harvest weight is calculated by multiplying the age specific catch (millions of fish) by mean weight in the harvest (2-year average, 2000-2001). The 2002 projected harvest estimates were influenced by new F_{opt} values, estimated selectivity, ADMB estimates of 2001 population size and fishing mortality, and full recruitment of the 1999 year class. The 2002 harvest is expected to be heavily dependent upon the 1998 (age 4) and 1999 (age 3) year classes. The task group maintains that conservative allocations are appropriate. Given improvements in growth, higher or steady abundance of ages 3 and older (fully recruited fish), and an improvement in yield per recruit (F_{opt}), we would expect to see RAH values at or above last year's recommendations. The YPTG recommends the following RAH ranges for each management unit:

- MU1 and MU2 - from the minimum to the maximum range presented in Table 7 with emphasis on staying near the mean value;
- MU3 - from the just below to around the mean value presented in Table 7;
- MU4 - from below up to the minimum value presented in Table 7.

The YPTG has made these recommendations to the LEC based on the need and desire for conservative harvest scenarios, incorporation of risk, protection of spawning stock biomass, and long-term management (or rehabilitation) strategies.

Additional Task Group Charges

Yellow Perch Stock Genetics

The task group has provided a collection of lakewide samples to Dr. Carol Stepien at Cleveland State University in support of genetic stock research in 2002. Initial results from prior years' samples have shown genetic differences between samples taken from the Western Basin (Mississippi refugium) and the Eastern Basin (Atlantic refugium). The YPTG members are also participating in a research project out of the University of Windsor, headed by Dr. Peter Sale, that is examining otolith microchemistry. Stock discrimination is necessary for assessment and research purposes, and also represents the basis for management unit delineation.

Yellow Perch Bioenergetics

In 2001, the task group provided abundance and growth data to the Forage Task Group to assist in bioenergetic modeling. The primary bioenergetics modeling effort has been focused on walleye and lake trout in recent years. If the LEC desires a yellow perch bioenergetics analysis, the task group would greatly benefit from further guidance and specific directives regarding the purpose or fundamental questions to be considered. In the absence of such direction, it is the Yellow Perch Task Group's suggestion that this charge be removed.

Conclusions

Task group methodology continues to evolve, incorporating powerful new techniques to better manage yellow perch stocks and harvest for the future. While advances using AD Model Builder were affirmed and refined in 2001, the task group is committed to advancing our techniques further. In 2002, we will address more of the recommendations provided by our reviewers to improve performance of our modeling tools. Task group members are grateful to Dr. Ransom Myers, Dr. Jim Bence, and Dr. Pat Sullivan for their continued comments on using AD Model Builder, yield per recruit, density-dependence models and newer harvest methodologies for our fisheries applications. We look forward to working and communicating with other researchers on our charges in the coming year.

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Table 1. Lake Erie yellow perch harvest in pounds by management unit (Unit) and agency, 1988-2001.

		Ontario*		Ohio		Michigan		Pennsylvania		New York		Total
	Year	Catch	%	Catch	%	Catch	%	Catch	%	Catch	%	Catch
Unit 1	1988	3,186,225	61	1,865,430	36	167,580	3	--	--	--	--	5,219,235
	1989	3,157,560	59	1,900,710	35	332,955	6	--	--	--	--	5,391,225
	1990	1,781,640	67	652,680	24	231,525	9	--	--	--	--	2,665,845
	1991	648,270	46	681,345	48	94,815	7	--	--	--	--	1,424,430
	1992	687,960	59	405,720	35	66,150	6	--	--	--	--	1,159,830
	1993	1,139,985	62	577,710	31	123,480	7	--	--	--	--	1,841,175
	1994	710,010	59	434,385	36	66,150	5	--	--	--	--	1,210,545
	1995	524,790	38	784,980	57	77,175	6	--	--	--	--	1,386,945
	1996	704,167	36	1,125,716	57	134,810	7	--	--	--	--	1,964,693
	1997	1,091,844	48	1,071,025	47	111,819	5	--	--	--	--	2,274,688
	1998	1,170,533	52	968,842	43	132,051	6	--	--	--	--	2,271,426
	1999	1,048,100	51	908,548	44	101,549	5	--	--	--	--	2,058,197
	2000	980,323	47	1,038,650	50	67,010	3	--	--	--	--	2,085,983
	2001	813,066	45	915,641	51	70,910	4	--	--	--	--	1,799,617
Unit 2	1988	5,596,290	93	421,155	7	--	--	--	--	--	--	6,017,445
	1989	5,578,650	84	1,071,630	16	--	--	--	--	--	--	6,650,280
	1990	2,873,115	75	952,560	25	--	--	--	--	--	--	3,825,675
	1991	2,171,925	76	683,550	24	--	--	--	--	--	--	2,855,475
	1992	2,522,520	83	500,535	17	--	--	--	--	--	--	3,023,055
	1993	1,933,785	80	493,920	20	--	--	--	--	--	--	2,427,705
	1994	1,300,950	55	1,045,170	45	--	--	--	--	--	--	2,346,120
	1995	1,073,835	57	804,825	43	--	--	--	--	--	--	1,878,660
	1996	1,290,998	61	823,425	39	--	--	--	--	--	--	2,114,423
	1997	1,826,180	63	1,079,882	37	--	--	--	--	--	--	2,906,062
	1998	1,797,458	74	627,944	26	--	--	--	--	--	--	2,425,402
	1999	1,572,829	62	974,123	38	--	--	--	--	--	--	2,546,952
	2000	1,484,125	56	1,169,234	44	--	--	--	--	--	--	2,653,359
	2001	1,794,275	51	1,747,069	49	--	--	--	--	--	--	3,541,344
Unit 3	1988	2,487,240	78	526,995	17	--	--	178,605	6	--	--	3,192,840
	1989	2,414,475	63	1,199,520	31	--	--	211,680	6	--	--	3,825,675
	1990	2,127,825	76	504,945	18	--	--	185,220	7	--	--	2,817,990
	1991	1,212,750	75	253,575	16	--	--	152,145	9	--	--	1,618,470
	1992	1,190,700	82	185,220	13	--	--	77,175	5	--	--	1,453,095
	1993	606,375	78	145,530	19	--	--	24,255	3	--	--	776,160
	1994	379,260	48	359,415	45	--	--	55,125	7	--	--	793,800
	1995	465,255	80	83,790	14	--	--	30,870	5	--	--	579,915
	1996	512,293	72	186,695	26	--	--	9,041	1	--	--	708,029
	1997	829,353	77	219,664	20	--	--	23,360	2	--	--	1,072,377
	1998	811,903	73	274,993	25	--	--	28,527	3	--	--	1,115,423
	1999	665,703	65	352,635	34	--	--	8,925	1	--	--	1,027,263
	2000	771,646	62	443,250	36	--	--	32,613	3	--	--	1,247,509
	2001	999,450	64	464,811	30	--	--	91,211	6	--	--	1,555,472
Unit 4	1988	568,890	98	--	--	--	--	2,205	<1	8,820	2	579,915
	1989	438,795	78	--	--	--	--	0	0	121,275	22	560,070
	1990	282,240	88	--	--	--	--	0	0	37,485	12	319,725
	1991	160,965	87	--	--	--	--	0	0	24,255	13	185,220
	1992	114,660	85	--	--	--	--	0	0	19,845	15	134,505
	1993	72,765	85	--	--	--	--	0	0	13,230	15	85,995
	1994	52,920	83	--	--	--	--	0	0	11,025	17	63,945
	1995	33,075	83	--	--	--	--	0	0	6,615	17	39,690
	1996	30,495	82	--	--	--	--	2,205	6	4,472	12	37,172
	1997	36,171	87	--	--	--	--	3,049	7	2,387	6	41,607
	1998	48,457	93	--	--	--	--	538	1	3,175	6	52,170
	1999	59,842	92	--	--	--	--	2,216	3	3,234	5	65,292
	2000	35,686	73	--	--	--	--	10,950	22	2,458	5	49,094
	2001	35,893	60	--	--	--	--	8,337	14	15,319	26	59,549
Lakewide Totals	1988	11,838,645	79	2,813,580	19	167,580	1	180,810	1	8,820	<1	15,009,435
	1989	11,589,480	71	4,171,860	25	332,955	2	211,680	1	121,275	1	16,427,250
	1990	7,064,820	73	2,110,185	22	231,525	2	185,220	2	37,485	<1	9,629,235
	1991	4,193,910	69	1,618,470	27	94,815	2	152,145	3	24,255	<1	6,083,595
	1992	4,515,840	78	1,091,475	19	66,150	1	77,175	1	19,845	<1	5,770,485
	1993	3,752,910	73	1,217,160	24	123,480	2	24,255	<1	13,230	<1	5,131,035
	1994	2,443,140	55	1,838,970	42	66,150	1	55,125	1	11,025	<1	4,414,410
	1995	2,096,955	54	1,673,595	43	77,175	2	30,870	1	6,615	<1	3,885,210
	1996	2,537,953	53	2,135,836	44	134,810	3	11,246	<1	4,472	<1	4,824,317
	1997	3,783,548	60	2,370,571	38	111,819	2	26,409	<1	2,387	<1	6,294,734
	1998	3,828,351	65	1,871,779	32	132,051	2	29,065	<1	3,175	<1	5,864,421
	1999	3,346,474	59	2,235,306	39	101,549	2	11,141	<1	3,234	<1	5,697,704
	2000	3,271,780	54	2,651,134	44	67,010	1	43,563	1	2,458	<1	6,035,945
	2001	3,642,684	52	3,127,521	45	70,910	1	99,548	1	15,319	<1	6,955,982

* processor weight

Table 2a. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 1 (Western Basin) by agency and gear type, 1988-2001.

		Unit 1			
		Michigan	Ohio		Ontario
	Year	Sport	Trap Nets	Sport	Gill Nets
Catch (pounds)	1988	167,580	626,220	1,239,210	3,186,225
	1989	332,955	864,360	1,036,350	3,157,560
	1990	231,525	463,050	189,630	1,781,640
	1991	94,815	196,245	485,100	648,270
	1992	66,150	123,480	282,240	687,960
	1993	123,480	158,760	418,950	1,139,985
	1994	66,150	165,375	269,010	710,010
	1995	77,175	108,045	676,935	524,790
	1996	134,810	200,313	925,403	704,167
	1997	111,819	211,876	859,149	1,091,844
	1998	132,051	184,142	784,700	1,170,533
	1999	101,549	200,939	707,609	1,048,100
	2000	67,010	240,541	798,109	980,323
	2001	70,910	179,234	736,407	711,745 *(a)*
					101,321 *(b)*
Catch (Metric) (tonnes)	1988	76	284	562	1,445
	1989	151	392	470	1,432
	1990	105	210	86	808
	1991	43	89	220	294
	1992	30	56	128	312
	1993	56	72	190	517
	1994	30	75	122	322
	1995	35	49	307	238
	1996	61	91	420	319
	1997	51	96	390	495
	1998	60	84	356	531
	1999	46	91	321	475
	2000	30	109	362	445
	2001	32	81	334	323 *(a)*
					46 *(b)*
Effort *(c)*	1988	494,158	6,900	1,153,182	9,616
	1989	696,973	8,418	1,028,551	12,716
	1990	634,255	6,299	350,000	18,305
	1991	164,517	7,259	700,719	13,629
	1992	120,979	6,795	350,433	9,221
	1993	244,455	7,092	530,012	12,006
	1994	224,744	5,937	469,959	11,734
	1995	123,616	5,103	598,977	11,136
	1996	193,733	4,869	772,078	8,614
	1997	192,605	5,580	834,934	13,704
	1998	183,882	5,446	863,336	19,095
	1999	184,710	5,185	941,350	12,846
	2000	122,447	4,026	965,628	6,741
	2001	97,761	1,518	686,937	2,167 *(a)*
					2,142 *(b)*
Catch Rates *(d)*	1988	0.5	41.2	4.2	150.3
	1989	1.7	46.6	2.8	112.6
	1990	1.3	33.3	1.4	44.1
	1991	1.9	12.3	2.4	21.6
	1992	2.1	8.2	2.8	33.8
	1993	1.9	10.2	2.6	43.1
	1994	1.1	12.6	2.2	27.4
	1995	2.8	9.6	4.3	21.4
	1996	3.3	18.7	4.9	37.0
	1997	2.8	17.2	3.7	36.1
	1998	3.2	15.3	3.8	27.8
	1999	2.1	17.6	3.3	37.0
	2000	2.2	27.1	3.0	66.0
	2001	2.9	53.5	3.4	149.1 *(a)*
					21.5 *(b)*

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 2b. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 2 (western Central Basin) by agency and gear type, 1988-2001.

		Unit 2			
		Ohio		Ontario	
	Year	Trap Nets	Sport	Gill Nets	
Catch (pounds)	1988	46,305	374,850	5,596,290	
	1989	200,655	870,975	5,578,650	
	1990	650,475	302,085	2,873,115	
	1991	302,085	381,465	2,171,925	
	1992	145,530	355,005	2,522,520	
	1993	114,660	379,260	1,933,785	
	1994	304,290	740,880	1,300,950	
	1995	257,985	546,840	1,073,835	
	1996	323,334	500,091	1,290,998	
	1997	498,945	580,937	1,826,180	
	1998	304,661	323,283	1,797,458	
	1999	389,973	584,150	1,572,829	
	2000	565,009	604,225	1,484,125	
	2001	905,088	841,891	1,593,704	*(a)*
				200,571	*(b)*
Catch (Metric) (tonnes)	1988	21	170	2,538	
	1989	91	395	2,530	
	1990	295	137	1,303	
	1991	137	173	985	
	1992	66	161	1,144	
	1993	52	172	877	
	1994	138	336	590	
	1995	117	248	487	
	1996	147	227	585	
	1997	226	263	828	
	1998	138	147	815	
	1999	177	265	713	
	2000	256	274	673	
	2001	410	382	723	*(a)*
				91	*(b)*
Effort *(c)*	1988	448	402,180	17,315	
	1989	1,403	572,612	25,679	
	1990	6,238	400,676	31,613	
	1991	6,480	452,277	34,739	
	1992	4,753	340,917	35,348	
	1993	2,558	320,891	25,569	
	1994	7,139	538,977	23,441	
	1995	6,467	388,238	18,337	
	1996	5,834	316,736	14,572	
	1997	8,721	575,365	24,974	
	1998	7,943	422,176	23,823	
	1999	7,502	563,819	13,179	
	2000	5,272	601,712	6,266	
	2001	4,747	581,118	3,445	*(a)*
				4,975	*(b)*
Catch Rates *(d)*	1988	46.9	2.4	146.6	
	1989	64.9	3.4	98.5	
	1990	47.3	1.5	41.2	
	1991	21.1	2.2	28.4	
	1992	13.9	3.0	32.4	
	1993	20.3	3.1	34.3	
	1994	19.3	3.3	25.2	
	1995	18.1	3.5	26.6	
	1996	25.1	4.2	40.1	
	1997	25.9	2.8	33.2	
	1998	17.4	2.6	34.2	
	1999	23.6	3.0	54.1	
	2000	48.6	2.9	107.4	
	2001	86.5	3.2	209.9	*(a)*
				18.3	*(b)*

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 2c. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 3 (eastern Central Basin) by agency and gear type, 1988-2001.

		Unit 3					
		Ohio		Ontario	Pennsylvania		
	Year	Trap Nets	Sport	Gill Nets	Gill Nets	Trap Nets	Sport
Catch (pounds)	1988	330,750	196,245	2,487,240	178,605		
	1989	635,040	564,480	2,414,475	211,680		
	1990	447,615	57,330	2,127,825	185,220		
	1991	185,220	68,355	1,212,750	152,145		
	1992	101,430	83,790	1,190,700	77,175		
	1993	68,355	77,175	606,375	24,255		
	1994	141,120	218,295	379,260	55,125		
	1995	63,945	19,845	465,255	30,870		
	1996	103,414	83,281	512,293	0	5,292	3,749
	1997	54,776	164,888	829,353	0	7,398	15,962
	1998	90,082	184,911	811,903	0	5,291	23,236
	1999	106,258	246,377	665,703	0	2,905	6,020
	2000	156,510	286,740	771,646	0	5,930	26,683
	2001	4,472	460,339	948,622 *(a)*	0	2,602	96,946
				50,828 *(b)*			
Catch (Metric) (tonnes)	1988	150	89	1,128	81		
	1989	288	256	1,095	96		
	1990	203	26	965	84		
	1991	84	31	550	69		
	1992	46	38	540	35		
	1993	31	35	275	11		
	1994	64	99	172	25		
	1995	29	9	211	14		
	1996	47	38	232	0	2.4	1.7
	1997	25	75	376	0	3.4	7.2
	1998	41	84	368	0	2.4	10.5
	1999	48	112	302	0	1.3	2.7
	2000	71	130	350	0	2.7	12.1
	2001	2.0	209	430 *(a)*	0	1.2	44.0
				23 *(b)*			
Effort *(c)*	1988	4,781	172,490	6,203	1,418		
	1989	7,281	248,530	7,098	1,037		
	1990	7,376	31,881	12,472	1,978		
	1991	4,516	54,607	12,247	2,018		
	1992	3,361	84,445	14,540	1,321		
	1993	2,610	96,619	10,017	620		
	1994	3,053	173,706	8,169	1,442		
	1995	3,258	42,234	6,843	1,465		
	1996	2,730	69,887	6,184	0	185	12,850
	1997	2,455	126,530	9,423	0	441	43,377
	1998	2,512	111,425	10,809	0	305	30,612
	1999	2,388	176,603	4,338	0	243	28,485
	2000	1,640	214,825	2,342	0	231	48,561
	2001	32	257,217	2,451 *(a)*	0	175	90,214
				1,047 *(b)*			
Catch Rates *(d)*	1988	31.4	2.7	181.8	57.1		
	1989	39.6	4.1	154.3	92.6		
	1990	27.5	1.9	77.4	42.5		
	1991	18.6	2.0	44.9	34.2		
	1992	13.7	1.8	37.1	26.5		
	1993	11.9	1.7	27.5	17.7		
	1994	21.0	2.3	21.1	17.3		
	1995	8.9	1.3	30.8	9.6		
	1996	17.2	2.8	37.5		13.0	0.8
	1997	10.1	3.1	39.9		7.6	0.9
	1998	16.3	3.6	34.0		7.9	1.4
	1999	20.2	3.5	69.6		5.4	1.3
	2000	43.3	3.0	149.4		11.6	1.9
	2001	63.4	2.9	175.4 *(a)*		6.7	2.6
				22.0 *(b)*			

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 2d. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 4 (Eastern Basin) by agency and gear type, 1988-2001.

		Unit 4					
		New York		Ontario	Pennsylvania		
	Year	Trap Nets	Sport	Gill Nets	Gill Nets	Trap Nets	Sport
	1988	8,820		568,890	2,205		
	1989	17,640	103,635	438,795	0		
	1990	19,845	17,640	282,240	0		
	1991	15,435	8,820	160,965	0		
	1992	11,025	8,820	114,660	0		
Catch	1993	6,615	6,615	72,765	0		
(pounds)	1994	4,410	6,615	52,920	0		
	1995	3,122	6,615	33,075	0		
	1996	2,822	1,650	30,495	0	0	2,205
	1997	1,241	1,146	36,171	0	0	3,049
	1998	1,345	1,830	48,457	0	0	538
	1999	694	2,540	59,842	0	0	2,216
	2000	625	1,833	35,686	0	0	10,950
	2001	27	15,292	34,284 *(a)*	0	0	8,337
				1,608 *(b)*			
	1988	4.0		258	1		
	1989	8.0	47.0	199	0		
	1990	9.0	8.0	128	0		
	1991	7.0	4.0	73	0		
Catch	1992	5.0	4.0	52	0		
(Metric)	1993	3.0	3.0	33	0		
(tonnes)	1994	2.0	3.0	24	0		
	1995	1.4	3.0	15	0		
	1996	1.3	0.7	14	0	0	1.0
	1997	0.6	0.5	16	0	0	1.4
	1998	0.6	0.8	22	0	0	0.2
	1999	0.3	1.2	27	0	0	1.0
	2000	0.3	0.8	16	0	0	5.0
	2001	0.01	6.9	16 *(a)*	0	0	3.8
				0.7 *(b)*			
	1988	2,132		2,719	8		
	1989	1,136	65,370	2,628	0		
	1990	981	24,463	3,924	0		
	1991	918	22,090	3,859	0		
	1992	632	52,398	3,351	0		
Effort	1993	761	26,297	2,008	0		
(c)	1994	555	14,800	1,642	0		
	1995	532	12,115	1,375	0		
	1996	533	6,535	1,063	0	0	7,292
	1997	292	8,905	1,073	0	0	13,747
	1998	178	7,073	1,081	0	0	3,784
	1999	118	5,410	872	0	0	13,623
	2000	44	2,606	314	0	0	21,146
	2001	39	22,950	128 *(a)*	0	0	12,451
				28 *(b)*			
	1988	1.9		94.9	125.0		
	1989	7.0	2.0	75.7			
	1990	9.2	0.3	32.6			
	1991	7.6	0.6	18.9			
	1992	7.9	0.3	15.5			
Catch Rates	1993	3.9	0.3	16.4			
(d)	1994	3.6	0.3	14.6			
	1995	2.7	0.5	10.9			
	1996	2.4	0.3	13.0			0.6
	1997	1.9	0.3	15.3			1.0
	1998	3.4	0.5	20.3			0.3
	1999	2.7	0.4	31.1			0.4
	2000	2.7	0.2	31.1			1.7
	2001	0.3	1.7	121.5 *(a)*			1.5
				26.0 *(b)*			

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 3. Lake Erie 2001 yellow perch harvest in numbers of fish by gear, age and management unit (Unit).

		Unit 1		**Unit 2**		**Unit 3**		**Unit 4**		**Lakewide**	
Gear	Age	Number	%	Number	%	Number	%	Number	%	Number	%
	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	16,174	0.6	573,501	9.5	133,068	4.9	0	0.0	722,743	6.3
	3	759,463	28.7	3,266,333	54.1	904,816	33.6	46,724	48.3	4,977,336	43.4
Gill Nets	4	563,527	21.3	1,002,019	16.6	480,315	17.8	21,191	21.9	2,067,052	18.0
	5	977,583	37.0	864,452	14.3	1,055,351	39.2	28,074	29.0	2,925,460	25.5
	6+	325,227	12.3	326,129	5.4	117,977	4.4	814	0.8	770,147	6.7
	Total	2,641,974		6,032,434		2,691,527		96,803		11,462,738	
	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	10,894	1.9	126,594	4.6	943	8.0	0	0.0	138,431	4.1
	3	207,161	35.6	1,418,999	51.3	7,585	64.4	36	58.1	1,633,781	48.6
Trap Nets	4	91,875	15.8	473,147	17.1	949	8.1	2	3.2	565,973	16.8
	5	241,981	41.6	740,670	26.8	2,236	19.0	13	21.0	984,900	29.3
	6+	29,668	5.1	6,929	0.3	67	0.6	11	17.7	36,675	1.1
	Total	581,579		2,766,339		11,780		62		3,359,760	
	1	0	0.0	4,060	0.2	0	0.0	0	0.0	4,060	0.1
	2	714,593	24.4	513,026	25.2	34,292	3.2	0	0.0	1,261,911	20.8
	3	1,353,784	46.3	1,085,597	53.3	404,085	38.2	21,849	44.3	2,865,315	47.2
Sport	4	187,145	6.4	126,165	6.2	107,474	10.2	2,728	5.5	423,512	7.0
	5	582,698	19.9	293,396	14.4	349,830	33.1	17,471	35.5	1,243,395	20.5
	6+	87,769	3.0	14,994	0.7	161,077	15.2	7,232	14.7	271,072	4.5
	Total	2,925,989		2,037,238		1,056,758		49,280		6,069,265	
	1	0	0.0	4,060	0.0	0	0.0	0	0.0	4,060	0.0
	2	741,661	12.1	1,213,121	11.2	168,303	4.5	0	0.0	2,123,085	10.2
	3	2,320,408	37.7	5,770,929	53.3	1,316,486	35.0	68,609	46.9	9,476,432	45.4
All Gear	4	842,547	13.7	1,601,331	14.8	588,738	15.7	23,921	16.4	3,056,537	14.6
	5	1,802,262	29.3	1,898,518	17.5	1,407,417	37.4	45,558	31.2	5,153,755	24.7
	6+	442,664	7.2	348,052	3.2	279,121	7.4	8,057	5.5	1,077,894	5.2
	Total	6,149,542		10,836,011		3,760,065		146,145		20,891,763	

Table 4. Yellow perch stock size (millions of fish) in each Lake Erie management unit. The years 1988 to 2001 are estimated by ADMB catch-age analysis in a commercial selectivity input (CSI) model. The 2002 population estimates use age 2 values derived from regressions of ADMB age 2 abundance against YOY and yearling trawl indices.

	Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Unit 1	2	21.382	2.225	3.728	10.077	13.733	4.297	10.063	22.879	26.946	22.556	50.553	10.683	43.721	27.058	2.633
	3	24.166	13.671	1.401	1.982	5.429	7.791	1.862	6.182	14.091	16.266	14.181	31.661	6.907	28.209	17.636
	4	24.216	11.604	5.722	0.535	0.633	1.998	2.204	0.835	2.806	6.278	7.868	7.444	18.082	3.978	17.178
	5	0.998	8.259	2.809	1.592	0.120	0.135	0.338	0.497	0.226	0.741	1.985	3.042	3.614	9.504	2.229
	6+	2.539	1.188	1.207	0.746	0.333	0.072	0.027	0.079	0.168	0.100	0.186	0.554	1.496	2.460	6.474
	2 and Older	73.301	36.947	14.867	14.931	20.248	14.293	14.494	30.472	44.236	45.942	74.774	53.383	73.821	71.209	46.152
	3 and Older	51.919	34.723	11.140	4.854	6.515	9.997	4.431	7.594	17.290	23.386	24.221	42.700	30.099	44.151	43.518
Unit 2	2	30.120	2.453	5.797	15.127	20.078	6.953	15.847	14.091	28.146	17.247	66.128	15.243	50.316	37.751	3.890
	3	15.523	18.638	1.485	2.359	6.359	9.679	3.322	9.143	7.976	13.789	9.017	35.413	9.425	30.469	22.421
	4	19.889	7.677	8.387	0.531	0.781	2.196	3.534	1.138	3.300	2.869	4.223	3.811	19.343	5.120	16.991
	5	0.161	7.827	2.624	2.162	0.122	0.213	0.639	0.721	0.248	0.557	0.490	0.905	1.880	9.338	2.443
	6+	0.517	0.335	2.001	0.974	0.554	0.187	0.104	0.151	0.193	0.074	0.073	0.088	0.414	1.074	4.978
	2 and Older	66.209	36.930	20.294	21.154	27.894	19.227	23.446	25.244	39.863	34.536	79.931	55.460	81.378	83.751	50.724
	3 and Older	36.089	34.477	14.497	6.026	7.816	12.274	7.599	11.153	11.717	17.290	13.803	40.216	31.062	46.001	46.833
Unit 3	2	11.777	2.880	3.215	6.683	5.159	2.699	5.594	5.982	10.505	7.036	26.064	5.951	21.100	7.035	1.601
	3	5.414	7.663	1.830	1.936	3.852	2.214	1.294	3.090	3.717	6.433	4.350	16.605	3.773	13.207	4.229
	4	19.599	3.194	4.173	0.751	0.749	1.235	0.847	0.615	1.807	2.064	3.299	2.484	10.267	2.254	7.750
	5	0.316	10.407	1.467	1.544	0.211	0.291	0.398	0.322	0.279	0.843	0.942	1.676	1.482	5.692	1.247
	6+	0.623	0.460	3.604	1.589	0.703	0.228	0.167	0.214	0.259	0.257	0.451	0.626	1.315	1.515	3.907
	2 and Older	37.729	24.604	14.289	12.503	10.673	6.667	8.301	10.223	16.566	16.632	35.107	27.342	37.937	29.703	18.734
	3 and Older	25.952	21.724	11.074	5.820	5.514	3.968	2.707	4.241	6.061	9.596	9.043	21.391	16.838	22.668	17.133
Unit 4	2	2.586	0.985	0.623	0.417	0.093	0.266	0.142	1.198	0.771	0.351	3.961	1.166	13.437	0.276	1.839
	3	1.612	1.695	0.641	0.402	0.265	0.062	0.167	0.090	0.788	0.508	0.231	2.653	0.772	8.964	0.185
	4	4.687	0.903	0.893	0.314	0.175	0.169	0.025	0.074	0.051	0.452	0.291	0.152	1.677	0.508	5.961
	5	0.261	2.221	0.353	0.313	0.086	0.098	0.038	0.007	0.033	0.024	0.221	0.182	0.093	1.079	0.335
	6+	0.143	0.200	0.910	0.568	0.327	0.237	0.116	0.061	0.036	0.035	0.032	0.151	0.200	0.188	0.831
	2 and Older	9.288	6.003	3.420	2.014	0.946	0.832	0.488	1.431	1.679	1.370	4.735	4.304	16.179	11.015	9.151
	3 and Older	6.702	5.019	2.797	1.597	0.853	0.566	0.346	0.232	0.908	1.019	0.774	3.139	2.742	10.739	7.312

Table 5. Projection of the 2002 Lake Erie yellow perch population. Stock size estimates are derived from ADMB CSI catch-age analysis. Age 2 estimates in 2002 are derived from regressions of ADMB age 2 abundance against YOY and yearling trawl indices. CV is coefficient of variation in stock size for the last year of ADMB catch-age analysis.

			2001 Parameters				Rate Functions					2002 Parameters				Stock Biomass			
			Stock Size (numbers)				Mortality Rates				Survival Rate		Stock Size (numbers)			Mean Weight in Pop. (kg)	millions kg		millions lbs.
	CV	**Age**	**Mean**	**Std. Err.**	**Min.**	**Max.**	**(F)**	**(Z)**	**(A)**	**(u)**	**(S)**	**Age**	**Mean**	**Min.**	**Max.**		**2001**	**2002**	**2002**
Unit 1		2	27.058	10.525	16.532	37.583	0.028	0.428	0.348	0.023	0.652	2	2.633	1.732	3.535	0.064	1.813	0.168	0.371
	0.389	3	28.209	10.973	17.236	39.182	0.096	0.496	0.391	0.076	0.609	3	17.636	10.776	24.497	0.098	3.018	1.732	3.818
		4	3.978	1.547	2.430	5.525	0.179	0.579	0.440	0.136	0.560	4	17.178	10.496	23.861	0.106	0.445	1.819	4.011
		5	9.504	3.697	5.807	13.202	0.206	0.606	0.454	0.154	0.546	5	2.229	1.362	3.096	0.147	1.483	0.327	0.721
		6+	2.460	0.957	1.503	3.417	0.246	0.646	0.476	0.181	0.524	6+	6.474	3.956	8.993	0.208	0.526	1.348	2.973
		Total	71.209	17.422	53.787	88.630	0.092	0.492	0.389	0.073	0.611	Total	46.152	28.322	63.982	0.117	7.286	5.395	11.896
		(3+)	44.151	10.802	26.976	61.326	0.134	0.534	0.414	0.104	0.586	(3+)	43.518	26.590	60.447	0.120	5.473	5.226	11.524
Unit 2		2	37.751	12.646	25.104	50.397	0.121	0.521	0.406	0.094	0.594	2	3.890	2.701	5.080	0.112	4.719	0.437	0.964
	0.335	3	30.469	10.207	20.262	40.676	0.184	0.584	0.442	0.139	0.558	3	22.421	14.910	29.932	0.153	5.241	3.433	7.569
		4	5.120	1.715	3.405	6.835	0.340	0.740	0.523	0.240	0.477	4	16.991	11.299	22.683	0.191	1.024	3.252	7.171
		5	9.338	3.128	6.210	12.466	0.336	0.736	0.521	0.238	0.479	5	2.443	1.624	3.261	0.244	2.512	0.596	1.313
		6+	1.074	0.360	0.714	1.434	0.355	0.755	0.530	0.249	0.470	6+	4.978	3.310	6.646	0.322	0.308	1.601	3.530
		Total	83.751	28.057	55.695	111.808	0.181	0.581	0.441	0.137	0.559	Total	50.724	33.845	67.602	0.184	13.804	9.319	20.548
		(3+)	46.001	15.410	30.591	61.411	0.234	0.634	0.469	0.173	0.531	(3+)	46.833	31.144	62.522	0.190	9.085	8.881	19.583
Unit 3		2	7.035	2.511	4.523	9.546	0.109	0.509	0.399	0.085	0.601	2	1.601	1.129	2.073	0.103	0.725	0.164	0.362
	0.357	3	13.207	4.715	8.492	17.922	0.133	0.533	0.413	0.103	0.587	3	4.229	2.719	5.738	0.147	1.994	0.624	1.375
		4	2.254	0.805	1.449	3.058	0.192	0.592	0.447	0.145	0.553	4	7.750	4.983	10.517	0.186	0.424	1.441	3.177
		5	5.692	2.032	3.660	7.724	0.212	0.612	0.458	0.159	0.542	5	1.247	0.802	1.692	0.235	1.349	0.293	0.647
		6+	1.515	0.541	0.974	2.056	0.214	0.614	0.459	0.160	0.541	6+	3.907	2.512	5.301	0.317	0.436	1.237	2.728
		Total	29.703	10.604	19.099	40.307	0.150	0.550	0.423	0.116	0.577	Total	18.734	12.145	25.322	0.201	4.928	3.759	8.289
		(3+)	22.668	8.093	14.576	30.761	0.163	0.563	0.431	0.125	0.569	(3+)	17.133	11.016	23.249	0.210	4.203	3.595	7.927
Unit 4		2	0.276	0.128	0.148	0.404	0.0001	0.400	0.330	0.000	0.670	2	1.839	1.168	2.510	0.090	0.023	0.166	0.366
	0.464	3	8.964	4.159	4.805	13.123	0.008	0.408	0.335	0.007	0.665	3	0.185	0.099	0.271	0.150	1.363	0.028	0.061
		4	0.508	0.236	0.272	0.744	0.018	0.418	0.342	0.015	0.658	4	5.961	3.195	8.727	0.198	0.100	1.182	2.606
		5	1.079	0.501	0.578	1.580	0.021	0.421	0.344	0.017	0.656	5	0.335	0.179	0.490	0.240	0.274	0.080	0.177
		6+	0.188	0.087	0.101	0.275	0.025	0.425	0.346	0.020	0.654	6+	0.831	0.446	1.217	0.354	0.067	0.294	0.648
		Total	11.015	5.111	5.904	16.126	0.010	0.410	0.336	0.008	0.664	Total	9.151	5.087	13.215	0.191	1.828	1.750	3.858
		(3+)	10.739	4.983	5.756	15.722	0.010	0.410	0.336	0.008	0.664	(3+)	7.312	3.919	10.704	0.217	1.804	1.584	3.492

Table 6. Estimated harvest of Lake Erie yellow perch for 2002. The exploitation rate is derived from optimal yield policy, and the stock size estimate are from ADMB CSI catch-age analysis and trawl regressions. Stock size and catch in numbers are in millions of fish. Catch weight is presented in millions of kilograms and pounds.

												Mean Wt.	RAH					
		Stock Size (numbers)			Exploitation Rate				Catch (millions of fish)			in Harvest	Catch (millions of kg)			Catch (millions of lbs)		
	Age	**Mean**	**Min.**	**Max.**	**F(opt)**	**s(age)**	**(F)**	**(u)**	**Mean**	**Min.**	**Max.**	(kg)	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**
Unit 1	2	2.633	1.732	3.535	0.466	0.114	0.053	0.043	0.112	0.074	0.151	0.106	0.012	0.008	0.016	0.026	0.017	0.035
	3	17.636	10.776	24.497	0.466	0.390	0.182	0.138	2.432	1.486	3.378	0.121	0.294	0.180	0.409	0.649	0.396	0.901
	4	17.178	10.496	23.861	0.466	0.728	0.339	0.240	4.117	2.516	5.719	0.134	0.552	0.337	0.766	1.217	0.743	1.690
	5	2.229	1.362	3.096	0.466	0.837	0.390	0.270	0.601	0.367	0.835	0.138	0.083	0.051	0.115	0.183	0.112	0.254
	6+	6.474	3.956	8.993	0.466	1.000	0.466	0.312	2.018	1.233	2.804	0.169	0.341	0.208	0.474	0.752	0.460	1.045
	Total	46.152	28.322	63.982				0.201	9.281	5.676	12.886	0.138	1.282	0.784	1.780	2.827	1.728	3.925
	(3+)	43.518	26.590	60.447				0.211	9.169	5.602	12.736	0.139	1.270	0.776	1.764	2.801	1.711	3.890
Unit 2	2	3.890	2.701	5.080	0.400	0.341	0.136	0.106	0.411	0.285	0.536	0.129	0.053	0.037	0.069	0.117	0.081	0.152
	3	22.421	14.910	29.932	0.400	0.518	0.207	0.155	3.484	2.317	4.651	0.136	0.474	0.315	0.633	1.045	0.695	1.395
	4	16.991	11.299	22.683	0.400	0.958	0.383	0.266	4.514	3.002	6.026	0.149	0.673	0.447	0.898	1.483	0.986	1.980
	5	2.443	1.624	3.261	0.400	0.946	0.379	0.263	0.643	0.427	0.858	0.172	0.111	0.073	0.148	0.244	0.162	0.325
	6+	4.978	3.310	6.646	0.400	1.000	0.400	0.275	1.371	0.911	1.830	0.257	0.352	0.234	0.470	0.777	0.517	1.037
	Total	50.724	33.845	67.602				0.205	10.421	6.942	13.901	0.159	1.662	1.107	2.217	3.665	2.441	4.889
	(3+)	46.833	31.144	62.522				0.214	10.011	6.657	13.365	0.161	1.609	1.070	2.148	3.548	2.360	4.737
Unit 3	2	1.601	1.129	2.073	0.418	0.509	0.213	0.159	0.255	0.180	0.330	0.129	0.033	0.023	0.043	0.072	0.051	0.094
	3	4.229	2.719	5.738	0.418	0.621	0.260	0.190	0.804	0.517	1.091	0.163	0.131	0.084	0.178	0.289	0.186	0.392
	4	7.750	4.983	10.517	0.418	0.897	0.375	0.261	2.023	1.301	2.745	0.170	0.344	0.221	0.467	0.758	0.487	1.029
	5	1.247	0.802	1.692	0.418	0.991	0.414	0.283	0.353	0.227	0.479	0.201	0.071	0.046	0.096	0.157	0.101	0.212
	6+	3.907	2.512	5.301	0.418	1.000	0.418	0.285	1.115	0.717	1.513	0.224	0.250	0.161	0.339	0.551	0.354	0.748
	Total	18.734	12.145	25.322				0.243	4.550	2.942	6.159	0.182	0.829	0.535	1.122	1.827	1.179	2.475
	(3+)	17.133	11.016	23.249				0.251	4.295	2.762	5.829	0.185	0.796	0.512	1.080	1.755	1.128	2.381
Unit 4	2	1.839	1.168	2.510	0.452	0.004	0.002	0.001	0.003	0.002	0.004	0.114	0.000	0.000	0.000	0.001	0.000	0.001
	3	0.185	0.099	0.271	0.452	0.320	0.145	0.112	0.021	0.011	0.030	0.142	0.003	0.002	0.004	0.006	0.003	0.009
	4	5.961	3.195	8.727	0.452	0.720	0.325	0.231	1.380	0.739	2.020	0.169	0.233	0.125	0.341	0.514	0.276	0.753
	5	0.335	0.179	0.490	0.452	0.840	0.380	0.264	0.088	0.047	0.129	0.180	0.016	0.009	0.023	0.035	0.019	0.051
	6+	0.831	0.446	1.217	0.452	1.000	0.452	0.304	0.253	0.136	0.370	0.205	0.052	0.028	0.076	0.114	0.061	0.167
	Total	9.151	5.087	13.215				0.191	1.744	0.935	2.553	0.174	0.304	0.163	0.445	0.671	0.359	0.982
	(3+)	7.312	3.919	10.704				0.238	1.741	0.933	2.549	0.174	0.304	0.163	0.445	0.670	0.359	0.981

Table 7. Lake Erie yellow perch recommended allowable harvest (RAH) estimates for 2002. Estimates are based on the F(opt) fishing strategy and the ADMB CSI model.

Yield (Millions of Pounds)

	RAH		
	Min.	Mean	Max.
Unit 1	1.728	2.827	3.925
Unit 2	2.441	3.665	4.889
Unit 3	1.179	1.827	2.475
Unit 4	0.359	0.671	0.982
Total	**5.708**	**8.989**	**12.271**

Yield (Millions of Kilograms)

	RAH		
	Min.	Mean	Max.
Unit 1	0.784	1.282	1.780
Unit 2	1.107	1.662	2.217
Unit 3	0.535	0.829	1.122
Unit 4	0.163	0.304	0.445
Total	**2.589**	**4.077**	**5.565**

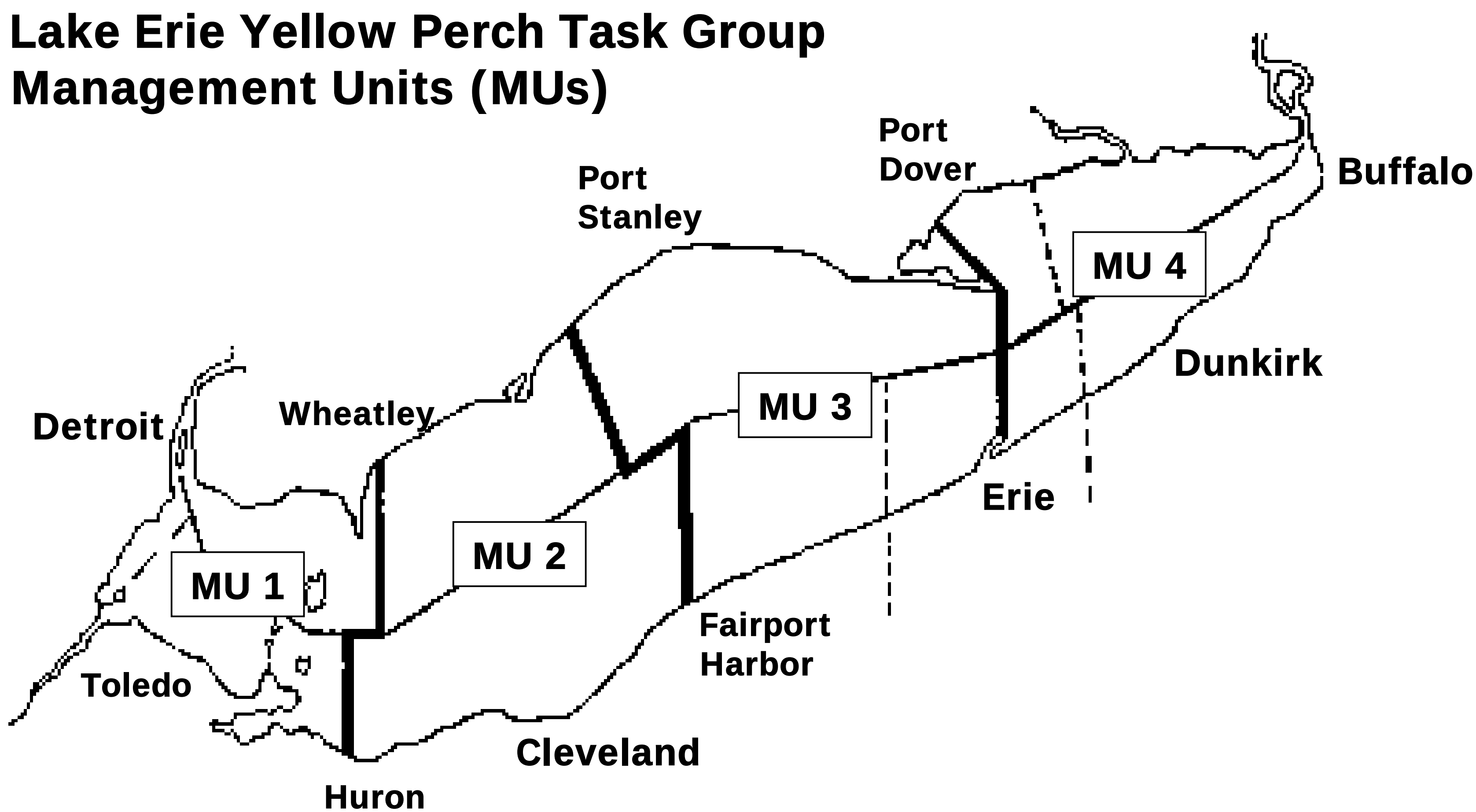

Figure 1. The Yellow Perch Task Group management units (MUs) of Lake Erie.

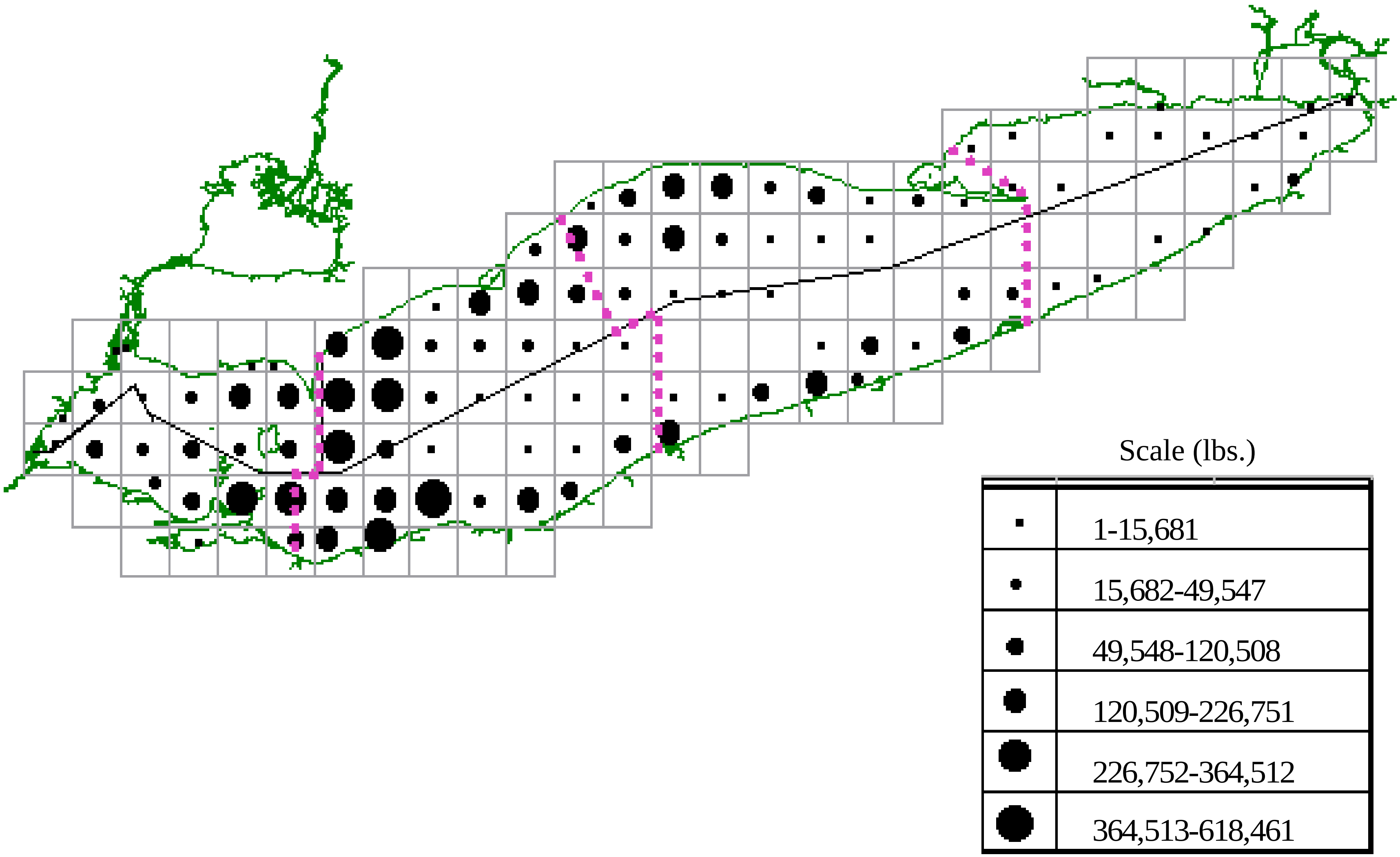

Figure 2. Spatial distribution of yellow perch harvest in 2001 by 10 minute grid.

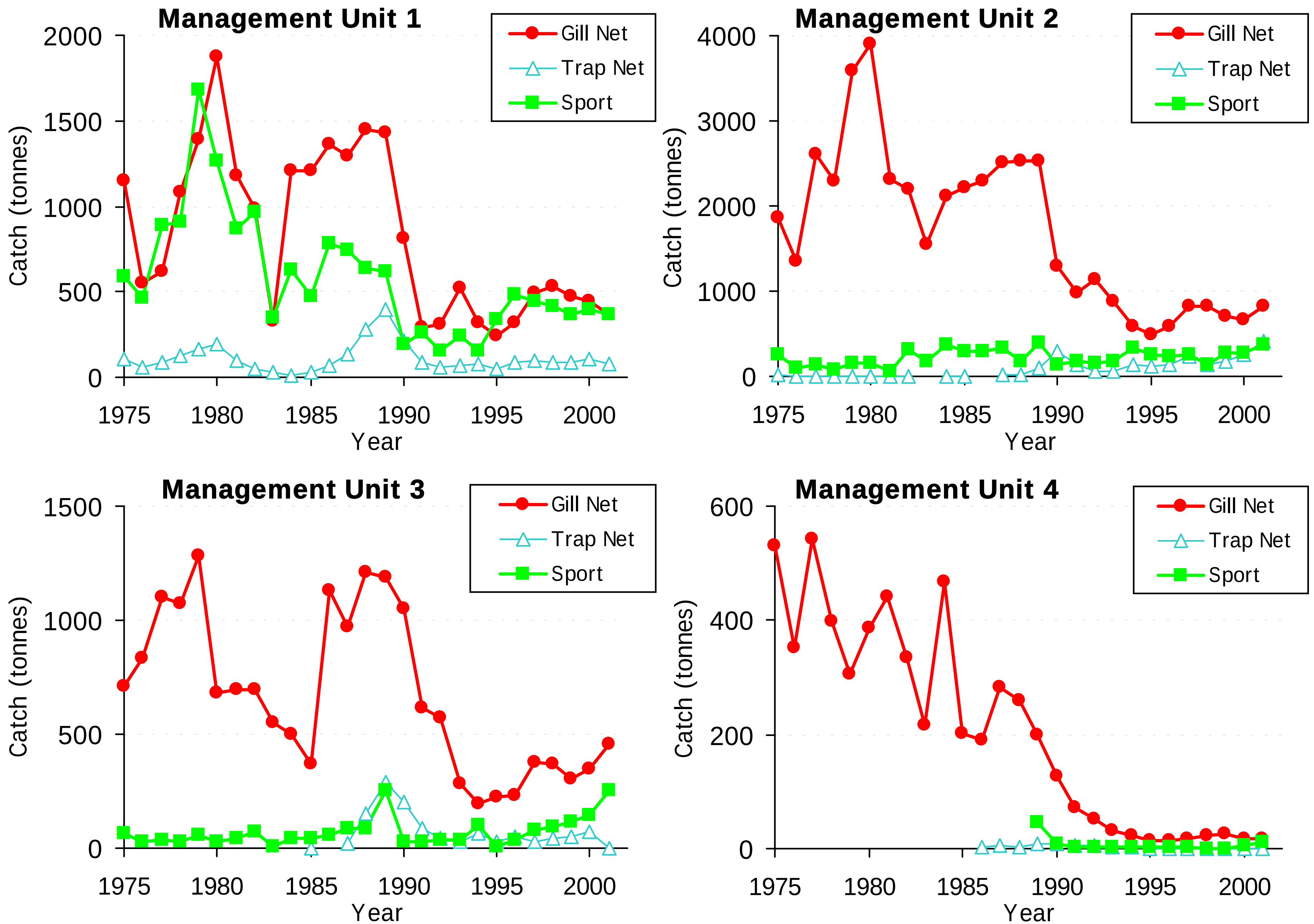

Figure 3. Lake Erie yellow perch harvest by management unit and gear type.

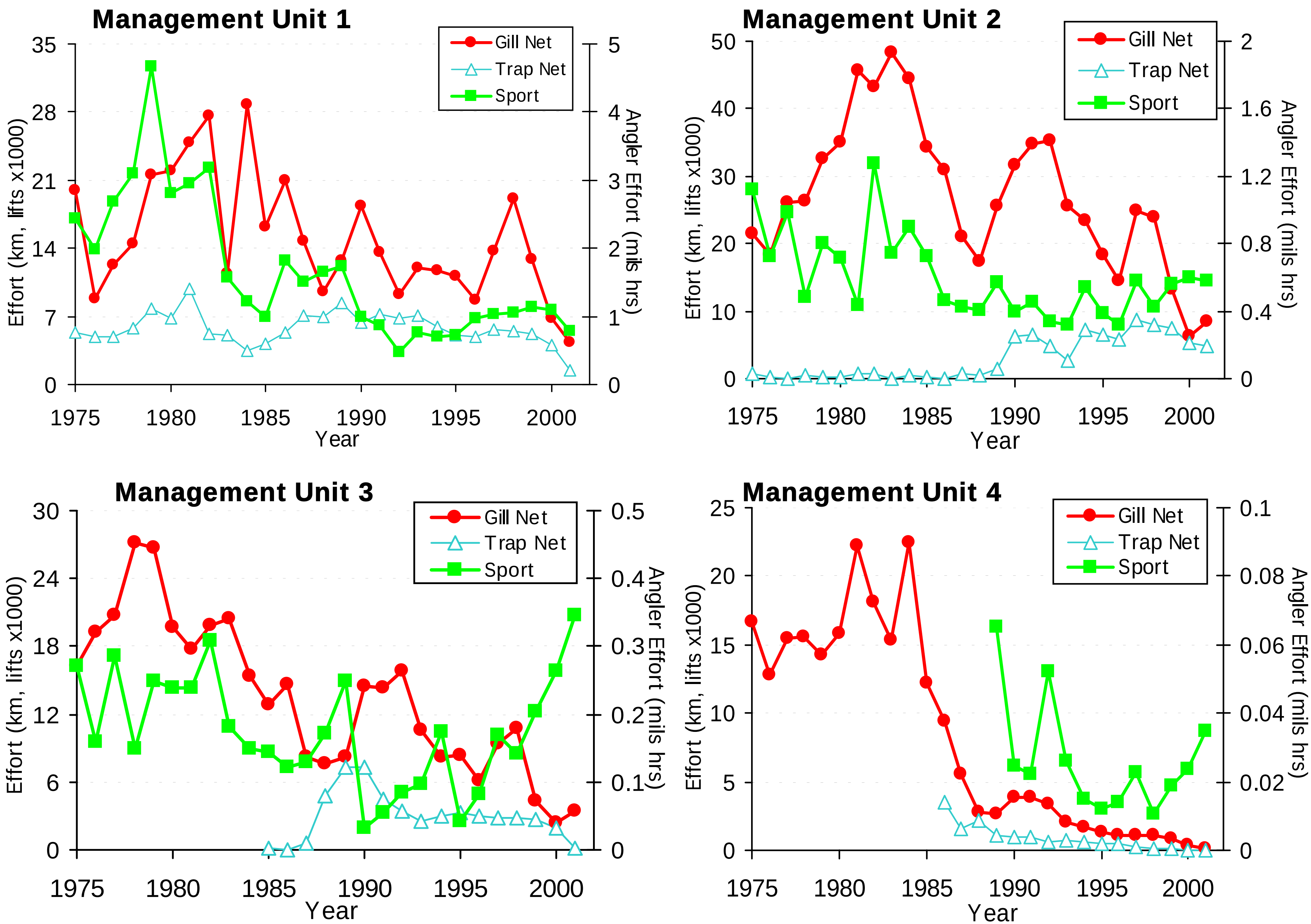

Figure 4. Lake Erie yellow perch effort by management unit and gear type. Note: 2001 gill net effort presented contains both small and large mesh.

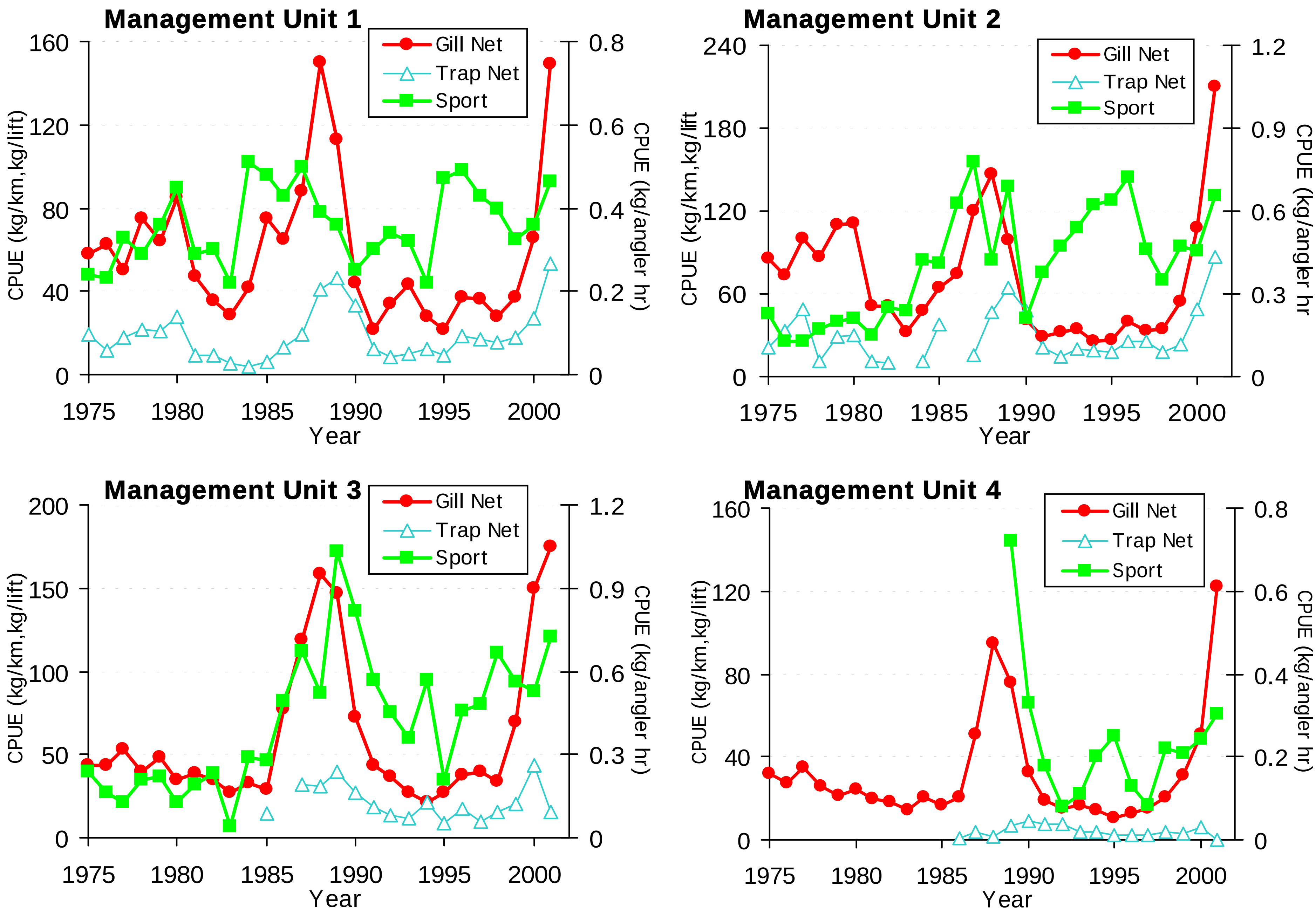

Figure 5. Lake Erie yellow perch catch per unit effort (CPUE) by management unit and gear type. Note: 2001 gill net CPUE is for small mesh only.

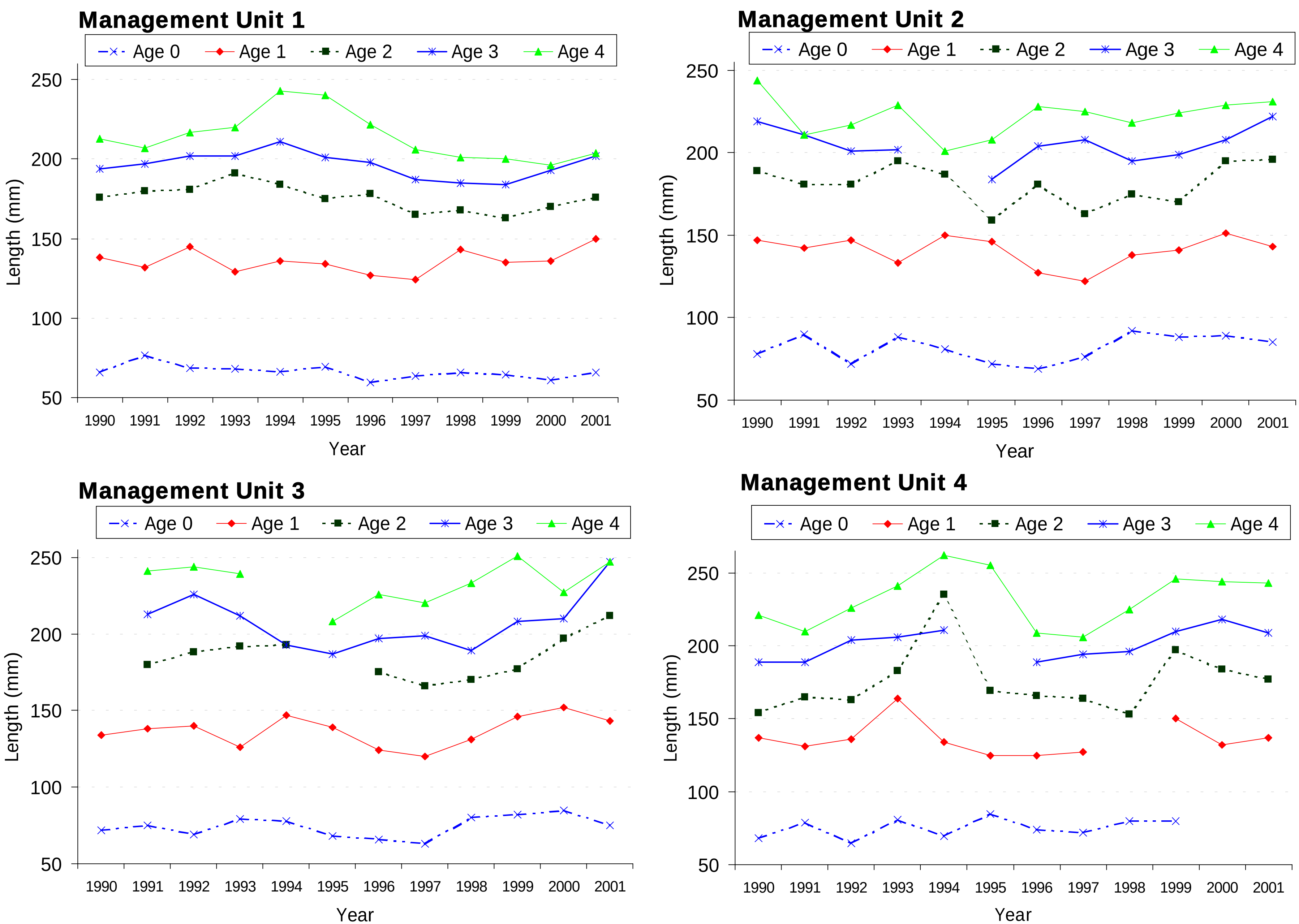

Figure 6. Yellow perch length-at-age from October interagency experimental samples for ages 0, 1, 2, and 4 in MU1-MU4.

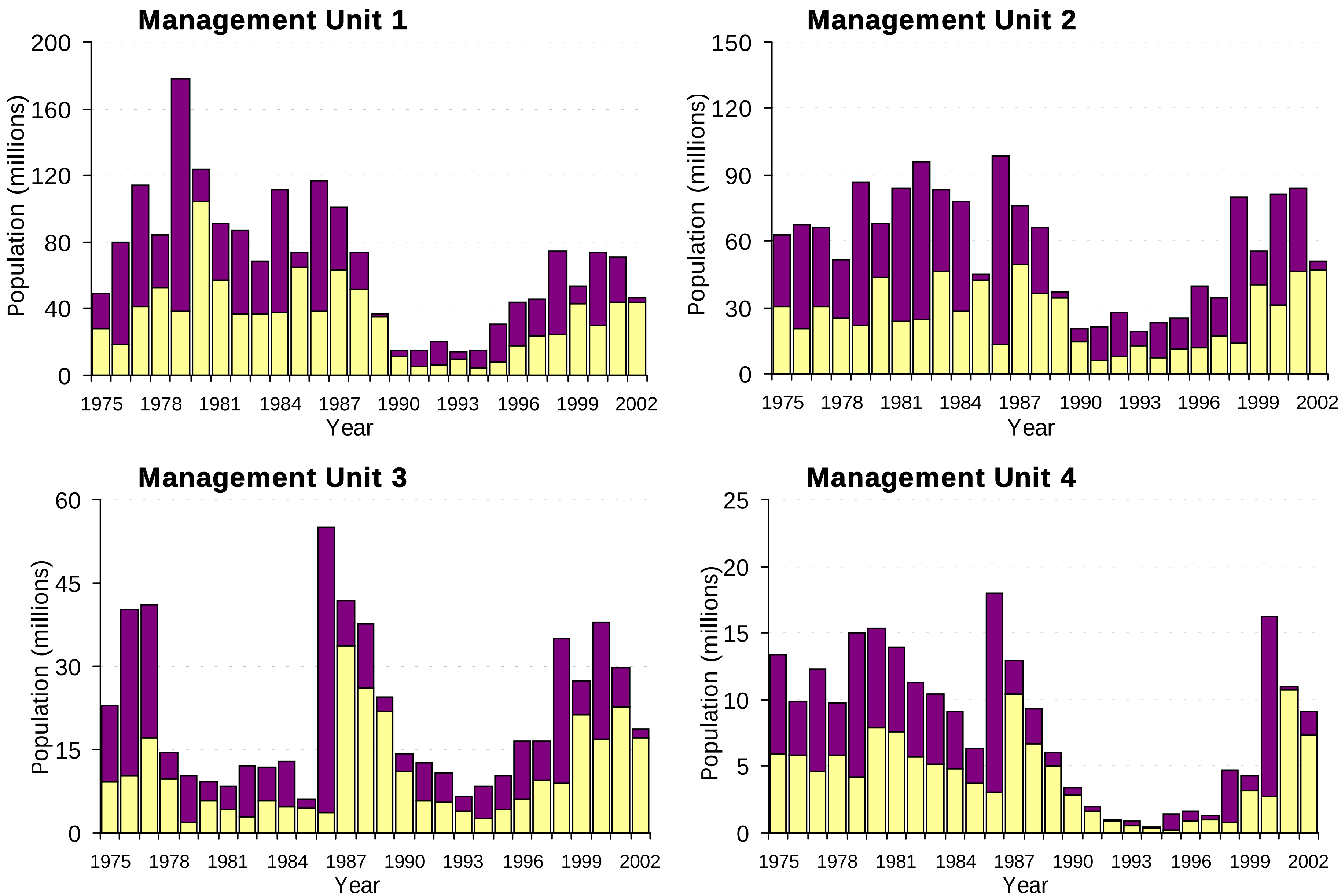

Figure 7. Lake Erie yellow perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2002 are from ADMB CSI Catch-Age and parametric regressions for age 2.

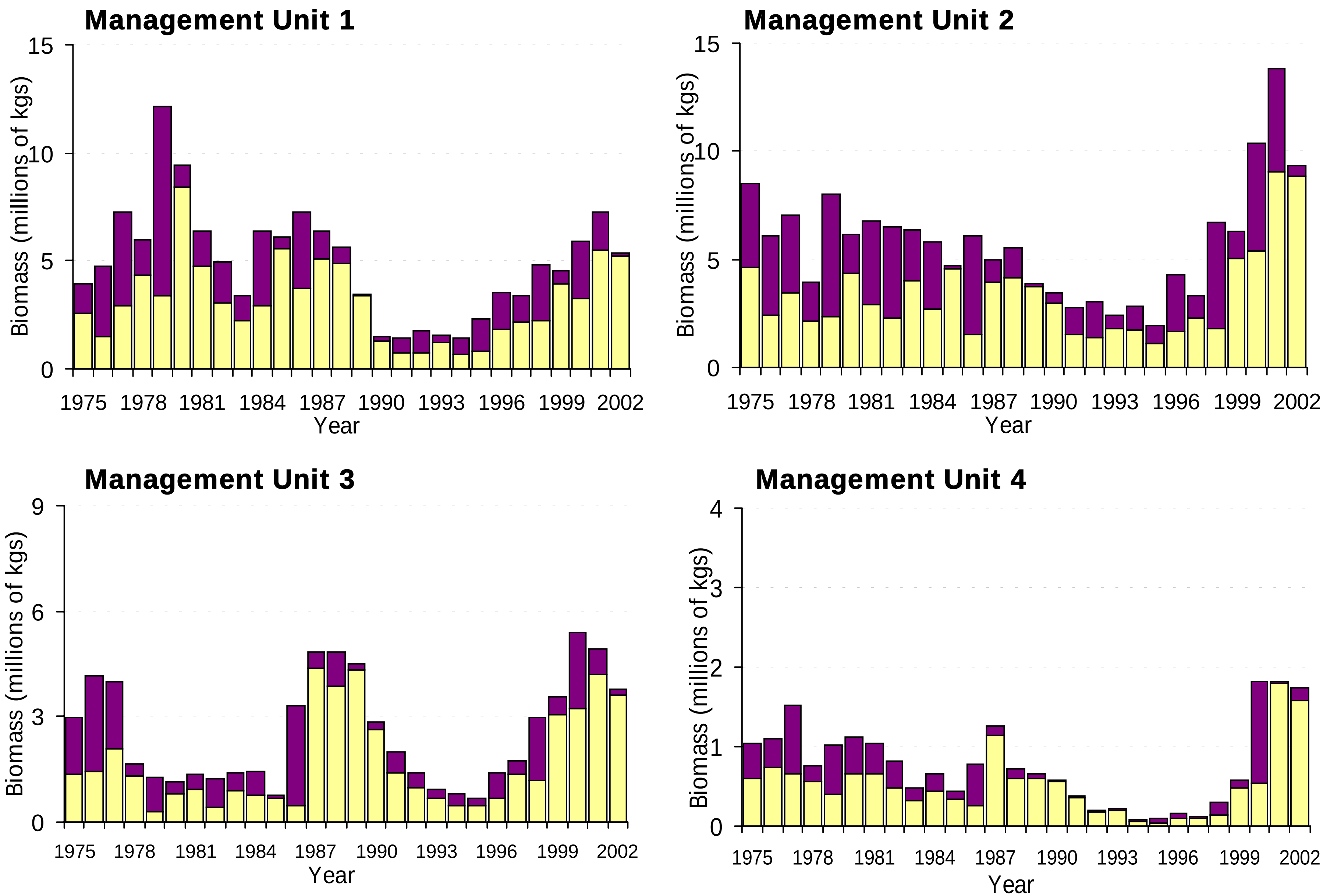

Figure 8. Lake Erie yellow perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2002 are from ADMB CSI Catch-Age and parametric regressions for age 2.

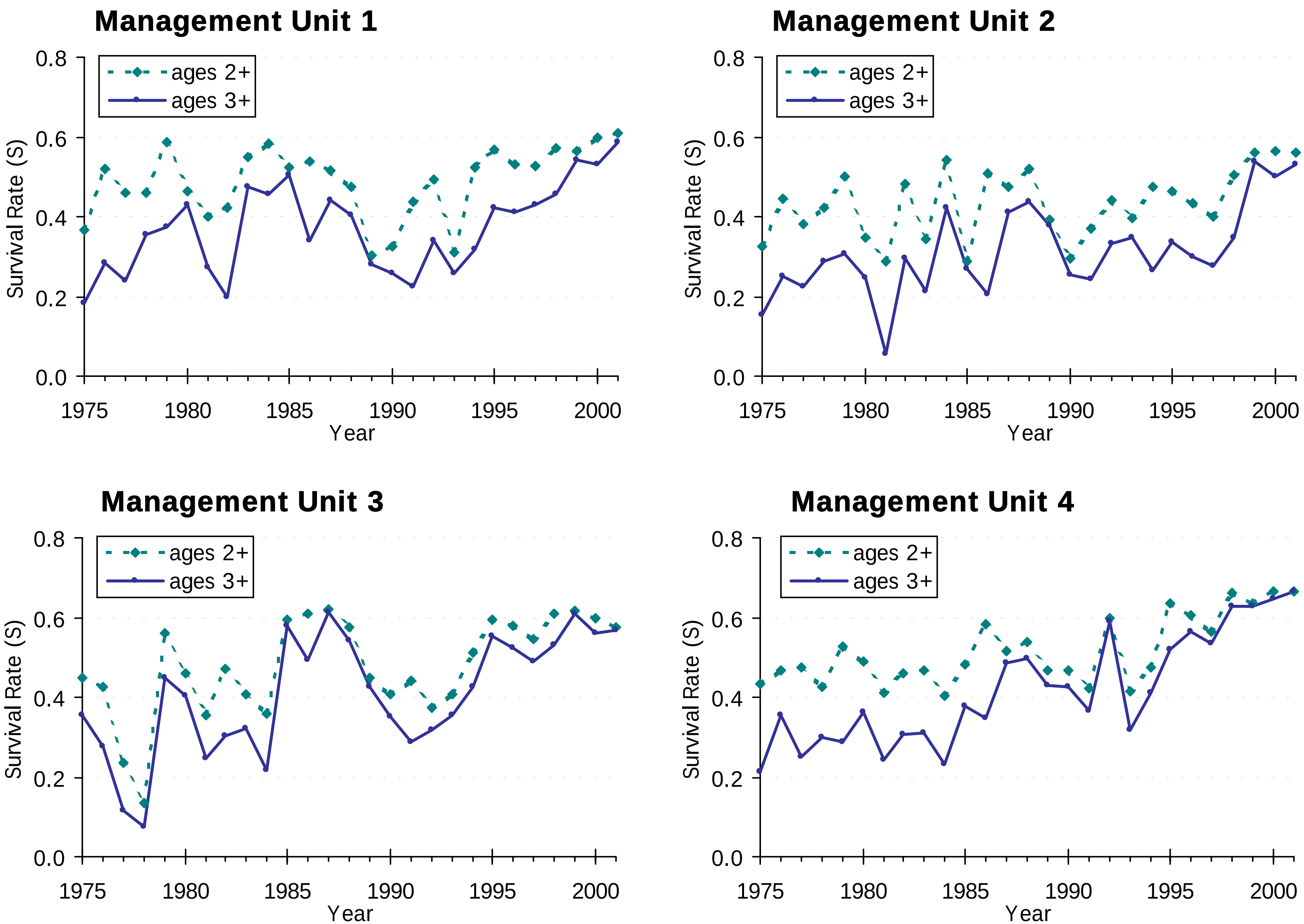

Figure 9. Lake Erie yellow perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB CSI Catch-Age model.

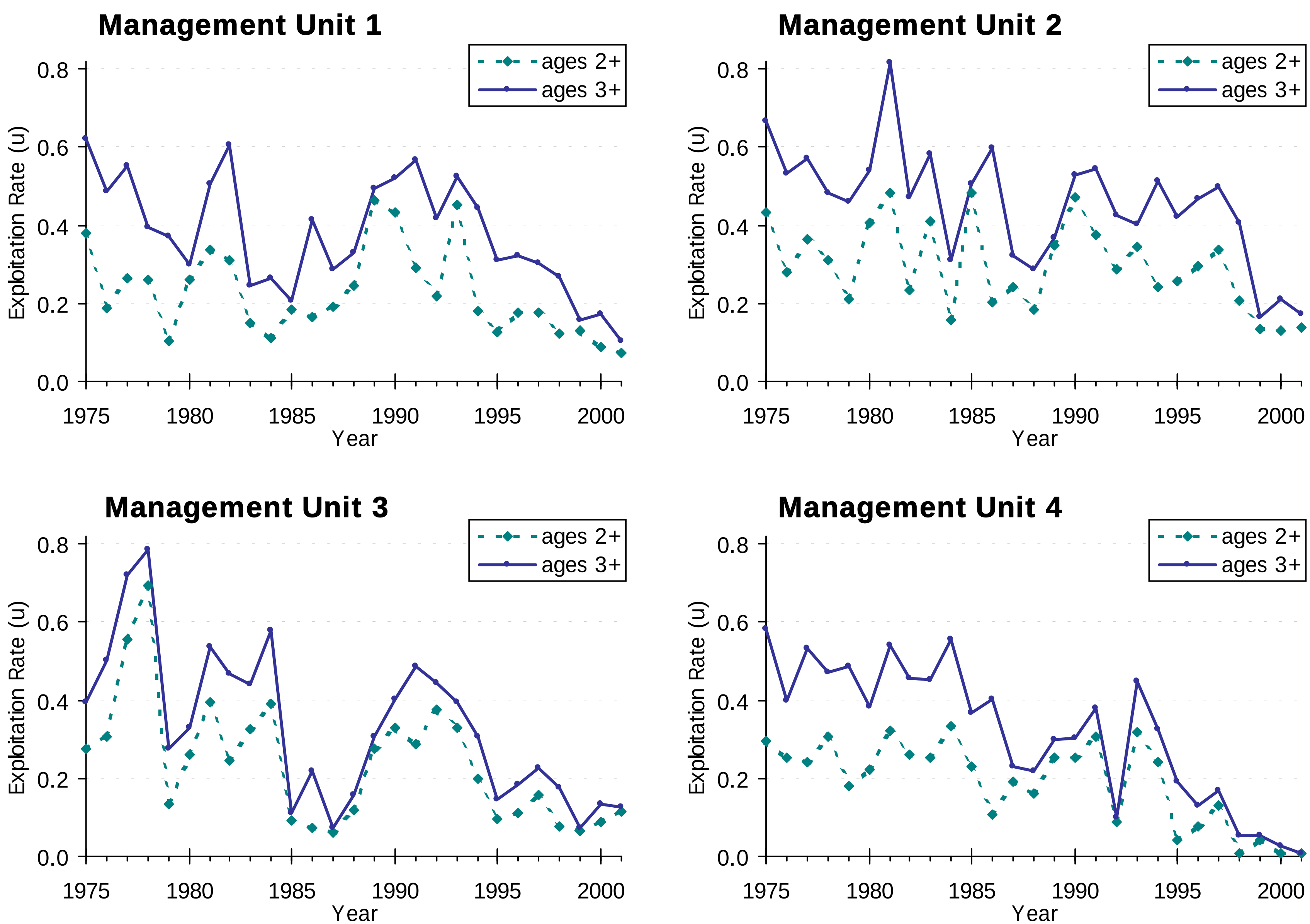

Figure 10. Lake Erie yellow perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB CSI Catch-Age model.

Appendix Table A-1. Agency trawl regression indices found statistically significant for projecting estimates of age 2 yellow perch by management unit.

Management Unit 1

Index	Slope	R-SQUARE	Index Value	Age-2 estimate	Upper Age 2 CI.	Lower Age 2 CI.	SE of slope
OHS11A	0.2670	0.8732	18.8	5.020	6.125	3.914	0.0294
OHF31A	0.3989	0.8729	1.0	0.399	0.500	0.298	0.0507
BOHF20G	0.6342	0.8253	5.5	3.488	4.622	2.354	0.1031
OHF10A	0.0907	0.8130	39.7	3.601	4.601	2.600	0.0126
USS11G	1.6938	0.7966	1.1	1.863	2.407	1.320	0.2471
OHF11G	1.1432	0.7797	5.7	6.516	8.965	4.068	0.2148
BOHF21A	0.1567	0.7430	15.5	2.429	3.381	1.477	0.0307
USF10G	0.2731	0.7120	4.9	1.338	1.830	0.846	0.0502
USF11A	0.6991	0.7116	2.8	1.957	2.677	1.238	0.1285
ONTS10A	0.0172	0.6837	75.4	1.297	1.810	0.784	0.0034
BOHS20G	1.2818	0.6161	0.3	0.385	0.599	0.170	0.3577
OHS10A	0.0183	0.5875	180.8	3.309	4.900	1.718	0.0044
			mean	**2.633**	**3.535**	**1.732**	

Management Unit 2

Index	Slope	R-SQUARE	Index Value	Age-2 estimate	Upper Age 2 CI.	Lower Age 2 CI.	SE of slope
OHF31A	0.4665	0.9285	1.0	0.467	0.553	0.380	0.0431
OHF20A	0.2047	0.9175	50.5	10.337	12.529	8.146	0.0217
OHS31G	2.7079	0.8865	5.3	14.352	17.983	10.720	0.3426
BOHF30G	1.7777	0.8723	0.8	1.422	1.807	1.037	0.2405
BOHF21A	0.1888	0.8394	15.5	2.926	3.779	2.074	0.0275
OHS11A	0.3026	0.8356	18.8	5.689	7.148	4.230	0.0388
USS11G	2.0022	0.8294	1.1	2.202	2.779	1.626	0.2621
OHF10A	0.1051	0.8130	39.7	4.172	5.332	3.013	0.0146
USF10G	0.3283	0.7666	4.9	1.609	2.121	1.096	0.0523
ONTS10A	0.0207	0.7364	75.4	1.561	2.104	1.018	0.0036
OHF11G	1.2498	0.7289	5.7	7.124	10.196	4.052	0.2695
BOHS20G	1.5742	0.7270	0.3	0.472	0.677	0.268	0.3411
USF11A	0.8011	0.6964	2.8	2.243	3.098	1.388	0.1527
OHS10G	0.1369	0.6473	44.0	6.024	8.593	3.454	0.0292
USS10A	0.0061	0.5538	115.8	0.706	1.077	0.336	0.0016
BOHS21A	0.0448	0.5490	21.0	0.941	1.508	0.374	0.0135
			mean	**3.890**	**5.080**	**2.701**	

Management Unit 3

Index	Slope	R-SQUARE	Index Value	Age-2 estimate	Upper Age 2 CI.	Lower Age 2 CI.	SE of slope
OHF20G	0.3416	0.9115	5.6	1.913	2.334	1.492	0.0376
OHF31A	0.2084	0.9081	1.0	0.208	0.253	0.164	0.0221
OHS31G	1.2320	0.9020	5.3	6.530	8.052	5.007	0.1436
BOHF30G	0.7931	0.8570	0.8	0.629	0.811	0.447	0.1145
BOHF21A	0.0827	0.7901	15.5	1.282	1.722	0.842	0.0142
BOHS20G	0.7124	0.7348	0.3	0.214	0.305	0.123	0.1513
PAF30G	0.1120	0.5657	14.4	1.613	2.428	0.798	0.0283
BOHS21A	0.0200	0.5377	21.0	0.420	0.680	0.160	0.0062
			mean	**1.601**	**2.073**	**1.129**	

Management Unit 4

Index	Slope	R-SQUARE	Index Value	Age-2 estimate	Upper Age 2 CI.	Lower Age 2 CI.	SE of slope
NYF41A	0.2113	0.8243	24.4	5.156	6.956	3.355	0.0369
OHS31G	0.5647	0.7847	5.3	2.993	4.102	1.884	0.1046
ILP41G	0.6045	0.6632	1.6	0.967	1.365	0.569	0.1244
BOHF31A	0.0659	0.5534	1.0	0.066	0.105	0.027	0.0197
ILP40G	0.0209	0.5430	0.7	0.015	0.022	0.007	0.0055
			mean	**1.839**	**2.510**	**1.168**	

Appendix Table A-2. Geometric index values from lakewide trawl surveys.

Year	ONTS10G	OHS10G	OHS11G	OHF10G	OHF11G	USS10G	USS11G	USF10G	USF11G	ONOHP10G	OHS20G	OHS21G	OHF20G	OHF21G	BOHS20G	BOHS21G	BOHF20G	BOHF21G
1980	-	10.5	0.0	69.0	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	-	3.0	7.9	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	49.4	30.0	13.8	31.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	1.4	2.0	0.0	2.2	-	4.0	16.0	2.8	17.5	-	-	-	-	-	-	-	-	-
1984	118.5	16.3	0.3	5.3	-	7.1	1.9	10.9	2.9	-	-	-	-	-	-	-	-	-
1985	36.0	7.0	0.0	3.9	-	6.5	8.4	28.8	12.8	-	-	-	-	-	-	-	-	-
1986	56.5	155.8	0.0	7.6	-	141.7	34.1	8.8	22.7	-	-	-	-	-	-	-	-	-
1987	0.5	4.3	31.6	4.1	-	1.4	17.3	4.3	12.3	3.9	-	-	-	-	-	-	-	-
1988	88.6	17.1	2.3	3.6	-	43.3	3.6	1.0	0.1	45.4	-	-	-	-	-	-	-	-
1989	127.0	20.4	2.9	18.8	-	32.6	8.1	20.0	1.0	61.9	-	-	-	-	-	-	-	-
1990	111.5	42.8	9.6	54.1	-	29.2	6.7	59.2	2.0	81.0	1.0	28.4	19.2	55.2	0.4	24.0	24.6	55.1
1991	41.3	20.1	10.8	14.4	0.2	16.9	17.1	63.4	4.9	33.6	1.9	28.5	4.3	57.2	1.4	28.1	4.9	66.6
1992	27.4	12.2	2.0	10.2	0.2	4.3	0.1	17.3	0.3	23.1	15.0	6.7	8.7	11.7	15.0	6.7	9.1	12.4
1993	80.2	86.8	6.6	24.0	0.2	28.8	0.9	17.3	0.2	107.5	4.0	24.3	9.4	28.7	4.0	24.3	9.9	25.2
1994	243.2	64.6	18.2	35.6	22.7	499.2	8.0	78.7	36.1	148.5	6.5	2.8	20.0	6.8	6.5	2.8	21.1	6.7
1995	51.9	26.3	46.4	30.6	0.1	475.2	23.1	9.3	4.4	51.1	0.8	20.0	2.9	45.8	0.8	20.0	2.7	35.8
1996	679.0	575.2	32.7	262.1	32.1	10633.1	5.3	228.7	3.9	649.2	61.0	2.7	95.0	5.4	47.8	2.7	94.5	4.9
1997	11.4	10.8	45.3	5.9	42.9	18.3	27.1	5.6	9.9	15.0	3.5	855.1	2.1	42.2	5.7	762.4	2.1	40.1
1998	112.4	71.8	2.8	104.4	6.8	74.4	3.8	100.9	6.7	100.5	16.9	1.8	70.4	3.1	12.9	2.0	70.4	3.1
1999	171.0	102.8	27.8	79.4	31.2	943.4	12.7	50.2	14.7	148.3	10.6	14.1	47.6	48.3	11.3	11.6	44.1	56.8
2000	16.3	44.0	46.1	13.3	19.5	11.1	5.4	4.9	9.0	32.3	0.3	27.8	5.6	39.2	0.3	34.2	5.5	45.7
2001	243.5	144.0	9.5	128.5	5.7	19.0	1.1	16.7	0.6	202.4	40.7	2.6	52.1	5.2	40.7	2.6	69.9	6.2

Year	OHS30G	OHS31G	OHF30G	OHF31G	BOHS30G	BOHS31G	BOHF30G	BOHF31G	PAF30G	PAF31G	ILP40G	ILP41G	OLP40G	OLP41G	NYF40G	NYF41G
1980	-	-	-	-	-	-	-	-	-	-	77.5	69.0	11.8	25.7	-	-
1981	-	-	-	-	-	-	-	-	23.0	-	357.4	29.9	21.6	1.7	-	-
1982	-	-	-	-	-	-	-	-	26.0	-	229.5	16.0	7.9	4.1	-	-
1983	-	-	-	-	-	-	-	-	0.5	-	25.6	-	0.0	0.0	-	-
1984	-	-	-	-	-	-	-	-	385.0	-	414.8	16.0	57.0	1.4	-	-
1985	-	-	-	-	-	-	-	-	4.0	-	6.0	32.7	0.7	5.6	-	-
1986	-	-	-	-	-	-	-	-	125.0	-	465.4	3.8	38.5	0.3	-	-
1987	-	-	-	-	-	-	-	-	25.0	-	0.7	2.6	1.1	10.8	-	-
1988	-	-	-	-	-	-	-	-	40.0	-	73.4	0.8	47.3	0.4	-	-
1989	-	-	-	-	-	-	-	-	0.5	-	70.0	6.4	18.0	6.8	-	-
1990	0.3	5.3	6.9	15.8	0.4	4.6	6.8	13.7	3.0	-	27.2	8.9	8.2	3.4	-	-
1991	2.0	6.3	0.9	18.7	1.6	12.6	0.9	13.3	5.0	-	8.0	2.8	2.0	0.5	-	-
1992	11.4	2.5	20.4	3.6	23.5	1.5	17.1	3.1	50.0	-	46.5	3.3	6.1	1.4	4.4	1.8
1993	6.6	4.7	13.8	12.6	6.1	4.1	12.2	10.6	38.0	-	19.2	5.8	6.2	1.2	54.9	2.1
1994	3.0	1.6	9.5	1.5	4.0	1.6	8.3	1.4	172.0	-	13.2	3.8	26.4	3.3	12.8	2.6
1995	4.5	9.2	11.6	35.1	4.5	9.2	10.9	36.3	20.0	-	1.2	5.4	2.4	10.4	4.9	9.6
1996	53.4	1.2	76.7	3.2	50.0	1.1	39.9	2.4	214.8	-	12.6	1.5	36.8	1.2	24.1	0.2
1997	-	-	2.0	7.5	-	-	1.8	5.5	0.0	-	3.1	1.6	2.6	4.5	0.1	1.5
1998	7.9	1.2	21.8	1.1	7.9	1.2	18.3	1.1	0.2	-	383.3	3.6	14.3	0.7	0.6	0.1
1999	11.0	22.2	12.0	22.2	11.0	22.2	11.8	21.9	15.0	9.0	5.1	17.6	0.6	8.8	5.6	3.9
2000	0.0	22.3	0.8	6.9	0.0	21.5	0.8	5.8	14.4	1.8	0.7	0.8	2.6	1.1	5.3	1.9
2001	38.5	5.3	35.0	0.5	38.5	5.3	34.8	0.4	35.8	1.5	169.7	1.6	26.1	0.5	112.3	13.8

Appendix Table A-3. Arithmetic index values from lakewide trawl surveys.

Year	ONTS10A	OHS10A	OHS11A	OHF10A	OHF11A	USS10A	USS11A	USF10A	USF11A	ONOHP10A	OHS20A	OHS21A	OHF20A	OHF21A	BOHS20A	BOHS21A	BOHF20A	BOHF21A
1980	-	122.0	0.0	663.7	191.0	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	-	29.5	56.0	110.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	965.6	359.1	124.3	854.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	3.3	30.5	0.0	5.8	-	19.8	59.2	15.0	43.3	-	-	-	-	-	-	-	-	-
1984	3020.8	138.3	0.8	110.0	-	28.5	5.8	46.4	11.8	-	-	-	-	-	-	-	-	-
1985	521.9	26.1	0.0	39.0	-	42.0	34.0	71.4	27.2	-	-	-	-	-	-	-	-	-
1986	1754.5	1143.7	0.0	61.5	-	1295.0	162.3	63.7	76.3	-	-	-	-	-	-	-	-	-
1987	0.7	20.0	104.4	18.0	-	5.0	41.0	12.8	61.2	10.8	-	-	-	-	-	-	-	-
1988	328.7	145.9	12.6	35.0	-	129.0	10.3	5.8	0.3	224.5	-	-	-	-	-	-	-	-
1989	788.4	107.2	15.7	113.5	-	149.8	15.7	34.2	3.3	447.9	-	-	-	-	-	-	-	-
1990	739.9	145.5	26.4	330.0	-	81.0	22.2	176.2	6.3	458.8	3.7	152.5	108.8	59.9	1.7	158.5	121.5	59.5
1991	111.4	139.3	34.1	61.8	0.6	185.2	35.0	210.8	18.0	125.4	10.7	95.7	27.0	120.8	8.4	91.9	29.5	128.3
1992	271.7	65.4	12.9	91.5	1.0	21.0	0.5	75.3	2.5	164.4	16.4	19.2	92.1	34.7	16.4	19.2	99.0	36.7
1993	766.9	1261.0	19.6	274.5	4.8	321.7	6.0	137.7	0.5	1052.5	104.0	72.5	23.9	92.7	104.0	72.5	25.3	86.9
1994	887.7	526.5	78.2	289.4	97.4	4404.2	40.3	162.0	57.8	702.5	144.2	12.3	155.7	26.9	144.2	12.3	165.6	26.1
1995	1337.8	348.0	167.8	81.6	0.2	2867.0	223.4	27.5	20.0	815.4	8.7	278.7	8.0	180.4	8.7	278.7	7.5	161.6
1996	3309.9	3284.9	105.5	644.2	121.5	11444.0	13.2	737.2	9.2	3296.2	2721.8	31.6	347.0	35.0	2411.0	28.6	343.7	33.7
1997	109.9	58.2	175.4	37.2	156.9	293.7	85.3	39.3	51.5	81.2	79.0	1848.0	24.2	402.1	116.3	1590.0	25.4	394.0
1998	285.4	195.4	7.4	281.7	23.3	138.7	11.0	246.2	19.4	236.0	641.1	7.2	199.7	7.4	561.6	8.1	199.7	7.4
1999	816.0	299.3	96.8	180.2	70.6	1234.8	29.2	176.5	28.8	534.2	85.7	52.9	172.1	113.8	93.8	47.8	157.5	123.8
2000	75.4	180.8	112.0	39.7	46.8	115.8	23.8	42.2	30.8	126.4	1.7	236.1	50.5	155.6	2.0	271.4	49.9	162.0
2001	998.0	361.6	18.8	262.9	14.3	57.5	3.3	56.8	2.8	703.3	854.0	21.0	321.8	14.6	854.0	21.0	365.1	15.5

Year	OHS30A	OHS31A	OHF30A	OHF31A	BOHS30A	BOHS31A	BOHF30A	BOHF31A	PAF30A	PAF31A	ILP40A	ILP41A	OLP40A	OLP41A	NYF40A	NYF41A
1980	-	-	-	-	-	-	-	-	-	-	191.0	207.5	38.1	59.7	-	-
1981	-	-	-	-	-	-	-	-	-	-	607.2	98.9	109.8	5.3	-	-
1982	-	-	-	-	-	-	-	-	-	-	840.2	142.3	54.4	18.7	-	-
1983	-	-	-	-	-	-	-	-	-	-	142.6	-	-	-	-	-
1984	-	-	-	-	-	-	-	-	-	-	1167.9	73.7	275.7	7.6	-	-
1985	-	-	-	-	-	-	-	-	-	-	24.6	138.7	3.6	71.3	-	-
1986	-	-	-	-	-	-	-	-	-	-	1324.5	41.2	122.8	0.9	-	-
1987	-	-	-	-	-	-	-	-	-	-	2.8	30.0	2.6	206.4	-	-
1988	-	-	-	-	-	-	-	-	-	-	269.5	3.6	476.1	0.7	-	-
1989	-	-	-	-	-	-	-	-	-	-	359.4	66.9	201.7	37.8	-	-
1990	1.9	22.7	52.5	33.6	2.7	20.9	55.2	29.9	-	-	181.6	31.6	36.4	12.6	-	-
1991	11.3	166.2	3.2	48.0	10.8	306.8	3.2	39.7	-	-	106.2	25.7	10.5	1.1	-	-
1992	45.5	10.4	68.2	7.8	60.1	7.0	58.6	7.8	-	-	428.4	24.3	39.6	7.9	23.0	5.0
1993	96.9	34.7	38.3	29.4	91.1	32.6	34.3	26.8	-	-	180.7	15.4	24.5	3.8	222.4	6.2
1994	176.7	33.5	35.0	9.8	224.1	33.2	33.2	9.3	-	-	67.0	22.9	114.6	12.7	102.9	18.7
1995	69.1	61.2	26.7	87.5	69.1	61.2	25.4	89.4	-	-	3.5	42.6	5.6	27.9	12.0	30.9
1996	5214.4	8.8	330.1	9.9	5160.4	8.5	265.8	8.6	-	-	48.6	5.5	167.0	2.7	232.1	0.7
1997	-	-	7.9	129.4	-	-	7.1	115.2	-	-	18.8	6.5	14.1	38.2	0.4	12.4
1998	751.3	8.5	105.6	3.0	751.3	8.5	100.5	3.0	32.5	-	1054.3	17.2	130.8	1.4	2.7	0.4
1999	122.3	173.3	60.1	110.7	122.3	173.3	60.3	112.4	30.6	47.4	23.8	104.4	1.9	41.9	73.3	62.3
2000	0.0	231.3	2.7	54.4	0.0	248.4	2.5	50.2	31.2	4.2	2.1	3.1	9.8	3.1	46.8	14.1
2001	3500.8	27.8	36.0	1.0	3500.8	27.8	36.0	1.0	177.0	4.3	483.2	5.3	54.1	1.1	207.5	24.4

Appendix Legend. Lakewide trawl index series names and codes used in the Appendix.

Geometric Means	
ONTS10G	Ontario Management Unit 1 summer age 0 geometric
OHS10G	Ohio Management Unit 1 summer age 0 geometric
OHS11G	Ohio Management Unit 1 summer age 1 geometric
OHF10G	Ohio Management Unit 1 fall age 0 geometric
OHF11G	Ohio Management Unit 1 fall age 1 geometric
USS10G	USGS Management Unit 1 summer age 0 geometric
USS11G	USGS Management Unit 1 summer age 1 geometric
USF10G	USGS Management Unit 1 fall age 0 geometric
USF11G	USGS Management Unit 1 fall age 1 geometric
ONOHP10G	Ontario/Ohio Management Unit 1 summer age 0 geometric
OHS20G	Ohio Management Unit 2 summer age 0 geometric
OHS21G	Ohio Management Unit 2 summer age 1 geometric
OHF20G	Ohio Management Unit 2 fall age 0 geometric
OHF21G	Ohio Management Unit 2 fall age 1 geometric
BOHS20G	Ohio Management Unit 2 summer age 0 geometric (blocked by depth strata)
BOHS21G	Ohio Management Unit 2 summer age 1 geometric (blocked by depth strata)
BOHF20G	Ohio Management Unit 2 fall age 0 geometric (blocked by depth strata)
BOHF21G	Ohio Management Unit 2 fall age 1 geometric (blocked by depth strata)
OHS30G	Ohio Management Unit 3 summer age 0 geometric
OHS31G	Ohio Management Unit 3 summer age 1 geometric
OHF30G	Ohio Management Unit 3 fall age 0 geometric
OHF31G	Ohio Management Unit 3 fall age 1 geometric
BOHS30G	Ohio Management Unit 3 summer age 0 geometric (blocked by depth strata)
BOHS31G	Ohio Management Unit 3 summer age 1 geometric (blocked by depth strata)
BOHF30G	Ohio Management Unit 3 fall age 0 geometric (blocked by depth strata)
BOHF31G	Ohio Management Unit 3 fall age 1 geometric (blocked by depth strata)
PAF30G	Pennsylvania Management Unit 3 fall age 0 geometric
PAF31G	Pennsylvania Management Unit 3 fall age 1 geometric
ILP40G	Inner Long Point Bay Management Unit 4 age 0 geometric
ILP41G	Inner Long Point Bay Management Unit 4 age 1 geometric
OLP40G	Outer Long Point Bay Management Unit 4 age 0 geometric
OLP41G	Outer Long Point Bay Management Unit 4 age 1 geometric
NYF40G	New York Management Unit 4 fall age 0 geometric
NYF41G	New York Management Unit 4 fall age 1 geometric

(continued)

Appendix Legend (continued)

Arithmetic Means	
ONTS10A	Ontario Management Unit 1 summer age 0 arithmetic
OHS10A	Ohio Management Unit 1 summer age 0 arithmetic
OHS11A	Ohio Management Unit 1 summer age 1 arithmetic
OHF10A	Ohio Management Unit 1 fall age 0 arithmetic
OHF11A	Ohio Management Unit 1 fall age 1 arithmetic
USS10A	USGS Management Unit 1 summer age 0 arithmetic
USS11A	USGS Management Unit 1 summer age 1 arithmetic
USF10A	USGS Management Unit 1 fall age 0 arithmetic
USF11A	USGS Management Unit 1 fall age 1 arithmetic
ONOHP10A	Ontario/Ohio Management Unit 1 summer age 0 arithmetic
OHS20A	Ohio Management Unit 2 summer age 0 arithmetic
OHS21A	Ohio Management Unit 2 summer age 1 arithmetic
OHF20A	Ohio Management Unit 2 fall age 0 arithmetic
OHF21A	Ohio Management Unit 2 fall age 1 arithmetic
BOHS20A	Ohio Management Unit 2 summer age 0 arithmetic (blocked by depth strata)
BOHS21A	Ohio Management Unit 2 summer age 1 arithmetic (blocked by depth strata)
BOHF20A	Ohio Management Unit 2 fall age 0 arithmetic (blocked by depth strata)
BOHF21A	Ohio Management Unit 2 fall age 1 arithmetic (blocked by depth strata)
OHS30A	Ohio Management Unit 3 summer age 0 arithmetic
OHS31A	Ohio Management Unit 3 summer age 1 arithmetic
OHF30A	Ohio Management Unit 3 fall age 0 arithmetic
OHF31A	Ohio Management Unit 3 fall age 1 arithmetic
BOHS30A	Ohio Management Unit 3 summer age 0 arithmetic (blocked by depth strata)
BOHS31A	Ohio Management Unit 3 summer age 1 arithmetic (blocked by depth strata)
BOHF30A	Ohio Management Unit 3 fall age 0 arithmetic (blocked by depth strata)
BOHF31A	Ohio Management Unit 3 fall age 1 arithmetic (blocked by depth strata)
PAF30A	Pennsylvania Management Unit 3 fall age 0 arithmetic
PAF31A	Pennsylvania Management Unit 3 fall age 1 arithmetic
ILP40A	Inner Long Point Bay Management Unit 4 age 0 arithmetic
ILP41A	Inner Long Point Bay Management Unit 4 age 1 arithmetic
OLP40A	Outer Long Point Bay Management Unit 4 age 0 arithmetic
OLP41A	Outer Long Point Bay Management Unit 4 age 1 arithmetic
NYF40A	New York Management Unit 4 fall age 0 arithmetic
NYF41A	New York Management Unit 4 fall age 1 arithmetic